ABSTRACT
                The American Association of Medical Colleges (AAMC) appointed a task
force in November 1999 to examine how AAMC member institutions and others were
developing, and could develop, new ways to integrate education and patient care.
Mechanisms were identified that would aid in reorienting residency programs to
education, rather than services. These were: (1) re-engineering services to
incorporate new medical technologies, greater efficiencies, and other improvements in
quality and cost-effectiveness; (2) introducing new educational technologies, such as
virtual surgery; (3) selectively shifting some resident tasks to nurses and other
personnel, creating new patient care teams; (4) adding content and implementing a
graduate medical education (GME) core curriculum at the institutional level; (5)
changing resident supervision and resident responsibilities in response to Medicare
requirements; and (6) expanding educational opportunities in outpatient and other non-
hospital settings. Appendix A contains some examples of clinical or educational
redesign that balances education and service, and appendix B lists experts consulted.
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Integrating Education and Patient Care

Observations from the GME Task Force

1

Contents

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Integrating Education and Patient Care

Observations from the GME Task Force

Background

Academic medical centers face conflicting pressures. On the one hand, they are asked to pro-
duce a socially desirable mix of physicians with the skills to succeed in a health care environment
that will continue to change rapidly during their careers. On the other, they are asked to
deliver patient care more efficiently to compete in the health care marketplace. The pressures
from these competing agendas are felt most intensely in graduate medical education (GME).

In 1998, AAMC President Dr. Jordan Cohen declared that modern teaching hospitals should
place more emphasis on education. His talk, "Honoring the 'E' in GME," was a thoughtful
analysis of the issues that bedevil residency programs struggling to maintain quality in the
face of increasingly intense, high-volume clinical activities. He recommended forming an AAMC
task force, composed of physician leaders, hospital executives and house staff, to study the
situation and propose recommendations.

The group was appointed in November 1999. Its charge was to examine how AAMC member
institutions and others were developing, and could develop, new ways to integrate education
and patient care. Mechanisms identified that would aid in reorienting residency programs to
education rather than services were as follows:

- Re-engineering service to incorporate new medical technologies, greater efficiencies,
  and other improvements in quality and cost-effectiveness;

- Introducing new educational technologies such as "virtual" surgery;

- Selectively shifting some resident tasks to nurses and other personnel, creating new
  patient care teams;

- Adding content and implementing a GME core curriculum at the institutional level;

- Changing resident supervision and resident responsibilities in response to Medicare
  requirements; and

- Expanding educational opportunities in outpatient and other non-hospital settings.

The task force has met a number of times. It has combed the literature for examples of clinical
or educational redesign that balance education and service. Some examples were subsequently
presented to the AAMC at its annual meeting in October 2000 (see Appendix A). The task
force also has contacted members of the AAMC Council of Academic Societies and Group on
Resident Affairs in search of innovations that might not appear in the refereed journals. In
addition, the task force consulted other experts on resident education (see Appendix B).

Problems and Needed Change

The task force has identified significant problems that are rooted in the history, culture, and funding of graduate medical education:

- Increase in the number of residents and a corresponding increase in their use as "cheap labor;"

- Too much non-educational work for residents, along with a decline in the overall educational content of their work;

- Imbalance between curricular needs and educational opportunities, (i.e., the kinds of patients residents encounter often are misaligned with what they need to learn);

- Increase in patient care "throughput," with faculty workloads in the past twenty years growing by as much as 200 percent;

- Decrease in direct faculty teaching of residents and general erosion of the learning environment;

- Increases in patient acuity and decreased lengths of stay, making conditions for house staff much more frenetic than in the past, with less time for residents to reflect on and learn from their experiences. Also there is less opportunity for residents to see the natural history of disease and the impact of their interventions;

- Duplication of effort because of billing rules, leading to lower revenues per doctor-hour;

- Workload shifts to nurses and other ancillary personnel who are in short supply, resulting in low morale and high turnover among those staff.

The task force unanimously agrees that graduate medical education must be redesigned to address these problems. The existing GME model is outdated. The education of residents is still built around rotational experiences in predominantly acute care settings, but that does not reflect today's reality.

Second and more compelling is that the status quo serves neither the residents, institutions nor the public as it should. Because of their heavy workloads, young doctors often don't have time to interact with patients and pursue their professional and personal development. Dissatisfaction is growing among all the stakeholders.

Barriers to change: There are formidable barriers to change. As pressing financial constraints threaten even core activities in many medical schools, hospitals and clinical departments, GME rarely rises to the highest priority for investment and renewal. Advocacy for GME at the local level is further undermined by its fragmentation into specialty and subspecialty programs with long traditions of departmental "ownership." Furthermore, approaches to re-engineering GME are likely to vary from one specialty to another.

Most institutions have minimal oversight of GME. Educational objectives and service expectations are far more consistent across diverse medical student clerkships than in residency programs.[1] Faculty members often don't advocate for limiting house staff work hours because their own lives could be adversely affected. Both faculty and house staff have difficulty balancing their clinical, academic and personal activities.[2]

Charitable foundations and other granting agencies haven't taken an interest in the restructuring of residency programs, even as they have supported innovations in undergraduate medical education. While their reluctance may reflect the Medicare-based funding of residency programs, the dearth of peer-reviewed educational grants with salary recovery for principal investigators has decreased the academic value of time invested by faculty in restructuring GME. This lack of funding for rigorous research and evaluation is reflected in the paucity of articles on GME in refereed journals and the lack of recognition for faculty achievements in GME innovation.

Finally, the perceived inflexibility of the ACGME and its Residency Review Committees (RRC) is believed to have inhibited innovation. Recent changes in the ACGME's emphasis may permit or even encourage new educational approaches.

A process for change: While restructuring GME for the modern era could encompass many changes in organization, curriculum and oversight, excellence in patient care is the necessary foundation for excellence in graduate medical education. At the same time, every hospital with GME should have resident education as a core mission. Achieving change in GME requires that current realities in service delivery be taken into account, e.g., short inpatient stays with quick workups, procedures performed on outpatients rather than inpatients, and rapid technological change in both service and education.

The task force has identified three fundamental goals:

1) Reduce the total number of hours residents devote to patient care of limited or no educational value, with patient care assignments made according to their curricular needs.

2) Enrich the educational content of residencies, paying attention to competency measures across the full spectrum of medical practice and the continuum of education.

3) Strengthen institutional oversight of GME programs.

The appropriate balance of patient care and education varies among specialties, programs, and rotations. Nonetheless, the large volume of clinical services required of current postgraduate trainees remains the single biggest obstacle to improving the educational content and ultimate value of GME. As a consequence, the task force has focused on innovations that reduce the amount of work residents perform and increase the effectiveness of their time spent delivering services.

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[1] Report of the AAMC Working Group on Institutional Accountability for GME.

[2] In his remarks at the 2000 AAMC Annual Meeting, Dr. Bryan points out that "one has to ask if whether, from the very beginning, faculty lifestyle and faculty convenience was a major raison d'etre for this system of education that we have all inherited."

An era of change: After the task force had discussed these issues for a year and a half, the ACGME independently proposed two new requirements that are remarkably consistent with the task force's thinking: limiting residents' work to 80 hours a week, and focusing on educational outcomes.

Limiting the workweek of residents to 80 hours is an important first step. It sets the stage for meaningful change in balancing education and service. Although it will be difficult for many programs to implement an 80-hour week rapidly, this requirement forces each ACGME-accredited program to rethink its position about graduate medical education and realistically shift the balance toward education.

The ACGME's Outcome Project aligns with the new duty hours requirement and formally ushers in the new era for American graduate medical education. The task force frequently discussed the "missing components" of a meaningful curriculum, especially those that relate to learning about the system in which one works, communication skills, professionalism and the meaningful use of data.

The task force believes that American graduate medical education is greatly in need of change. Catalyzed by the new ACGME requirements, it is time to make the change felt throughout our systems. Graduate medical education has changed little since the term "resident" was coined in the early 20th century. While there have been pockets of innovation and forward movement, they have neither gone far enough nor been sufficiently broad in scope.

In the following sections, we summarize the historical developments in graduate medical education, review selected efforts to "re-engineer" patient care and education and, finally, suggest action steps, including those recently taken by the ACGME, to improve GME. The solutions are varied and complex, especially when considering the wide range of practice settings and training requirements. We hope this report will motivate and embolden institutions to address these critical issues seriously—not just to meet the new regulatory requirements but to push the envelope as graduate medical education enters a new era in American medicine.

A Short History of Graduate Medical Education:
It helps to recall the origins and historical development of GME. The term "resident" was introduced at the Johns Hopkins Hospital in the 1890s. The position was modeled on the "assistantships" then prevalent in Germany. William Osler, chief of medicine during the early days at Johns Hopkins, is often quoted, "In the natural method of teaching, the student begins with the patient, continues with the patient, and ends his studies with the patient, using books and lectures as tools, as means to an end."[3]

Osler's remark became a motto for educators, but it could just as well be a motto for those who value residents mainly as a workforce. From the beginning, the relationship of residents to teaching hospitals was, as one historian puts it, "a marriage of convenience."[4] Residents during

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[3] William Osler, "The Natural Method of Teaching the Subject of Medicine," JAMA 1901, 36: 1673-1679.

the early days were house officers in the most literal sense. They lived, unmarried, in the hospital while professors such as Osler and Howard A. Kelly maintained lucrative private practices. At a dinner meeting of residents at Johns Hopkins in 1899, Thomas B. Futcher brought laughter when he "arose very solemnly, assuming an attitude against the back of a chair somewhat like the leaning tower of Pisa, and with a very earnest attitude, began, 'Gentlemen, we cannot all live in the Johns Hopkins Hospital forever.'"[5] Residents constituted a workforce that served the hospital and protected faculty lifestyles.

By the 1940s, hospitals and attending physicians realized that they could double or triple their patient volumes and workloads by employing poorly paid residents. After World War II, the number of residency positions increased far beyond the capacity of United States medical schools to fill them. After 1970, many residency programs were characterized by less emphasis on academics and an increasingly frenetic pace of work.[6] Moreover, residents felt less camaraderie with their counterparts in different programs and thus felt less sense of belonging to a metaphorical family.

Recent trends have been largely detrimental to resident education. Rising health care costs shifted power and control from providers to third-party payers, and the payers became increasingly disinclined to finance medical education. The new medical economics threatened the solvency of medical schools, academic medical centers and teaching hospitals that served primarily the poor. As medical schools came to rely more heavily on clinical revenues, faculty members were rewarded more for practice than for teaching. The learning environment deteriorated. As Dr. K.M. Ludmerer puts it, residents were "reduced to work-up machines and disposition arrangers."[7]

Although the ACGME, which had emerged out of the AMA Committee on Medical Education, and the specialty certifying boards continued to insist on tight standards of education, they could not regulate local environments that were increasingly pressured by managed care. Newer specialties that had grown up in the new environment, notably Family Medicine and Emergency Medicine, were more adaptable than the traditional hospital-based specialties.

As the 20th century ended, the issue of balancing education and service in residency programs began to attract public attention. Concern about patient safety grew with the publication of To Err is Human by the Institute of Medicine in 1998. And a drumbeat of press articles about resident overwork and fatigue reinforced the call to control demands on residents.

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[4] C.E. Rosenburg, *The Care of Strangers: The Rise of America's Hospital System*, New York: Basic Books, 1987: 166-189.

[5] William S. Thayer to Lewellys F. Barker, May 6, 1899. Lewellys F. Barker Papers, Alan Mason Chesney Archive Center, The Johns Hopkins University.

[6] This issue became the focus of the Libby Zion Case and initiated a number of changes, including the New York 405 regulations limiting resident hours.

[7] K.M. Ludmerer, *Time to Heal: American Medical Education from the Turn of the Century to the Era of Managed Care*, New York: Oxford University Press, 1999: 349-399.

Review of the Literature

Using specially designed methods, the task force conducted a comprehensive search and evaluation of medical literature concerning re-engineering service and education in graduate medical education.[a] The task force identified the search terms, which were refined by the AAMC staff. A subgroup developed a system for grading published works according to their potential validity, usefulness, applicability and fulfillment of the three goals cited.

Literature Grading Criteria

1) Re-engineering strategies benefit both patient care and resident education.

2) Results improve both patient care and resident education.

3) Additional benefits are realized (i.e., education of midlevel practitioners).

4) Relevant stakeholders are involved in planning, implementation and evaluation (resident, program directors, department heads, nurses, patients and families, attending physicians, hospital administration, fiscal managers, quality assurance personnel, ancillary care providers).

5) Rationale(s) for change is/are discussed in the paper.

6) Re-engineering plan is based on analysis of institutional patient care and financial data.

7) Explicit goals for the re-engineered program are included.

8) There is a formal evaluation plan that includes criteria for judging outcomes.

Since optimal change would improve both resident education and patient care (or would not improve one at the expense of the other), the first criterion was whether re-engineering strategies were organized with both missions in mind. Articles that met this criterion were given one point. A second point was given if the results of the study demonstrated improvement in both patient care and resident education. A third point was awarded if there were additional benefits in educating other students, including midlevel practitioner students, medical students, and nursing students. A fourth point was given if other stakeholders were involved in the planning, implementation and/or evaluation of the intervention. Thus, the task force searched for involvement of residency program directors; other residents and faculty; other medical staff, such as nurses; and administrators, such as hospital directors, fiscal managers and quality assurance personnel. Fifth, credit was given if the authors had actually discussed a sound rationale for the proposed change.

Additional points were given to reflect the thoughtfulness and thoroughness of the investigators in creating the intervention and its evaluation. A point was given if the re-engineered plan was based on analysis of institutional data related to both costs and patient care. Another point was provided if there were explicit goals for the re-engineered program. And the last point was credited if a formal evaluation plan was used to evaluate the outcomes. A maximum of eight points were possible for any given article.

Following the bibliographic search, papers that were considered potentially relevant were reviewed. A total of 227 references were selected for initial review. Of those, forty-four (19 percent) were considered sufficiently relevant to be reviewed in detail. Only fourteen of these showed sufficient quality to figure in this report (6 percent). In all fourteen, the rationale for change related directly to decreasing residents' work hours, with fewer service-related activities and more time for education. An increase in exposure to ambulatory care was also a rationale for change.

The programs studied employed four approaches: (1) the implementation of night float teams; (2) the addition of other providers for hospital services, including nurse practitioners and physician assistants; (3) the use of attending physician services that were separate from resident services; and (4) the provision of new technologies to facilitate education. Finally, some programs were beginning to use competence-based instruction to improve previously unstandardized education.

Notable studies: One of the highest-ranked studies was by Abrass et al. from Harborside Hospital and the University of Washington.[9] It focused on the allocation of patients coming to the emergency room with three common medical problems, who were then triaged for admission to a "short-stay unit" staffed by physician assistants and nurse practitioners. Clinical guidelines for patient care were defined. Medical subspecialists supervised the short-stay unit team. Both patient care and fiscal data, including actual revenues and costs of staffing the unit, were obtained to compare how well the team served patients versus similar patients' care before the team approach. Clinical outcomes included responses to treatment, adverse events, mortality, use of ancillary services, length of stay and readmission rates. In addition, residents and staff physicians on the general medicine wards were surveyed to assess the quality of their educational experiences before and after activation of the unit. Since the unit was designed to accommodate physician assistant and nurse practitioner students, their experiences were also monitored and compared to controls. The same methods were used to evaluate residents, fellows and faculty placed on the unit.

After a year, the program has been judged a success, with improvements in resident education, lower workloads and stress, and improved patient care. The program also saved money for the hospital.[10]

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[9] C.K. Abrass et.al., "A Process for Reducing Workload and Enhancing Residents' Education at an Academic Medical Center," *Acad Med* 76: 798-805, 2001.

[10] Personal communication from Christine Abrass, M.D., April 21, 2002.

A second noteworthy study, by Holzman and others[11], concerns a project at St. Thomas Hospital, Nashville, an affiliate of Vanderbilt School of Medicine. The project was designed to address criticisms of the postgraduate medical education in surgical training. The study was prompted by concerns that reducing residents' work hours would compromise continuity of care and, in the process, the quality of both patient care and resident education. It was already acknowledged, however, that many non-physician tasks routinely performed by residents could be done just as well by a night nurse. With that experience serving as a pilot, the role of the night nurse was expanded, so that the nurse would be in the hospital from 7 a.m. to 7 p.m., Sunday through Friday. The night nurse went on rounds with the residents at the beginning of the evening, when care plans and concerns were discussed, and then followed defined protocols. All pages except emergencies were directed to the nurse.

The study continued for thirty consecutive days. Work conditions and education for the residents and quality of patient care were evaluated. The residents and the nurses kept diaries of all pages they received. The residents also documented time slept and times awakened during call. When the nurse was working, the residents received far fewer calls and slept an average of 2.5 more hours. Quality of patient care, assessed before and after implementation of the service by morbidity and mortality statistics, remained unchanged. Another benefit was the training of additional nurses. The authors reported that the system allowed residents to maintain meaningful continuity of patient care as well as increased time for patient evaluation, self-education and uninterrupted sleep.

A third highly scored study was reported by Nemes et al. from the Department of Surgery at the Children's Hospital at Harvard Medical School.[12] This project was necessitated when "downsizing" of house staff threatened to place an even heavier burden on residents. The authors proposed use of pediatric nurse practitioners to improve working conditions. Two nurse practitioners were recruited and began working in roles analogous to those of junior residents. The impact of the program was evaluated after one year by a questionnaire distributed to all attending surgeons, house staff and patients' parents.

Residents and attending physicians were enthusiastic about the program and agreed that the nurse practitioners had decreased residents' workload. Most did not feel that the nurses had interfered with the residents' learning, and in fact a majority believed that the nurses had helped the residents communicate with patients. The vast majority of residents said the nurses were a valuable resource. Finally, almost all the parents were pleased with the involvement of the nurses in their children's care. The study did not scrutinize either the fiscal impact or the impact on patient care outcomes.

A fourth highly ranked paper involved a longer timeframe. John Russell and others reported on twenty years' experience in placing midlevel practitioners in surgery at New Britain General

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[11] M.D. Holtzman et al., "Expanding the Physician Care Team: Its Effect on Paitent Care, Resident Function, and Education." *Journal of Surgical Research* 56:636-640, 1994.

[12] J. Nemes et.al., "Experience with a Nurse Practitioner Program in the Surgical Department of a Children's Hospital," *Journal of Pediatric Surgery* 27:1028-1042, 1992.

Hospital.[13] Early on, leaders at the hospital had recognized that the downsizing of residencies and the migration of residents to outpatient settings increased their service needs and potentially decreased time for education. The hospital implemented a physician assistant program to support the increased service requirements and make more time available to educate residents. The authors demonstrated that the use of physician assistants improved coverage for surgical patients and improved quality of care while protecting the integrity of the residency program.

Unlike some others, this paper's authors noted some disadvantages of their intervention. There was variable job satisfaction and considerable turnover among the physician assistants. There were also non-recoverable expenses associated with the midlevel practitioners' program, including their salaries and benefits, and, at the same time, the loss of otherwise recoverable Medicare DME and IME reimbursements that additional residents' positions would have provided.

In another study, Simmer et al. performed a prospective, randomized trial at the Henry Ford Hospital in Detroit to compare clinical and financial outcomes for general medicine inpatients assigned to resident (traditional teaching) or staff (non-teaching) services. Key outcome measures included length of stay, total charges, laboratory, radiology, pharmacy and supplies charges, in-hospital and six months post-discharge mortality rates, and two weeks' readmission rates. Patients admitted to the staff service had shorter stays, lower average total charges, and lower laboratory and pharmacy charges, but no statistically significant differences in mortality rates or readmission rates. The authors concluded that the addition of an attending service was a financially viable way to reduce house officer workloads, to offer more opportunities for training in ambulatory settings, and to adjust to a smaller pool of applicants for residency positions. The authors did not discuss turnover rate or job satisfaction among the faculty service providers.

Despite these useful examples, the literature was disappointingly sparse in identifying meaningful examples of measurable change that might fulfill the task force's goals. It is clear that rebalancing education and service requires some reassignment of services from residents to other providers. In the best cases, those changes can occur while preserving continuity in training for residents and quality of care for patients. But the evidence on the fiscal aspects of these changes and staff satisfaction is mixed. And there is reported dissatisfaction among some non-resident providers in their new roles. Most recently, these non-resident providers have been in extremely short supply.

Clearly, no panacea was identified. The promising approaches were to substitute faculty physicians or ancillary staff for some resident patient responsibilities; or increase faculty involvement in service; increase educational efficiency through technology. To reduce residents' patient care responsibilities, match their patient care activities to educational needs, and enrich the content of their education, however, means that resources must be reallocated, in some cases producing additional costs.[15]

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[13] J.C. Russell, "One Hospital's Successful 20-year Experience with Physician Assistant in Graduate Medical Education," Academic Medicine 74:641-645, 1999.

[14] T.L. Simmer et.al., "A Randomized, Controlled Trail of an Attending Staff Service in General Internal Medicine," Medical Care 29 Supplement: 31-40, 1991.

[15] Rosemarie Fisher, presentation at AAMC annual meeting, 2000.

Discussion

As noted earlier, consensus has developed among faculty, residents and administrators of teaching hospitals that major restructuring of GME is needed to better serve the development of young medical professionals. Unfortunately, house staff in today's teaching hospitals are so deeply integrated into the delivery of clinical services that, at a time of falling reimbursements and shortages of nursing and other health care professionals, reducing the service role of residents to enhance their educational opportunities remains a daunting task. Indeed, the difficulties of effecting change may have far greater financial impact and more complex institutional effects than those encountered in modifying undergraduate medical education, itself a notoriously slow and difficult process.

The difficulties notwithstanding, the task force recommends the following steps to improve graduate medical education.

1) **Residency programs need to develop educational goals and objectives, as well as competency-based criteria for measuring outcomes, to define more specifically the desirable volume and distribution of clinical work.**

Despite the best intentions, GME probably will not improve unless and until residents are not expected to deliver clinical services beyond those required for attaining and demonstrating clinical proficiency. To gauge the impact of reducing the expectations for clinical service by residents, we can look at institutions that have reduced the size of their residencies for other reasons, such as fiscal constraints or re-evaluation of the need for specific types of practitioners. In October 1997, the AAMC Group on Resident Affairs conducted a comprehensive review of this process. The group considered whether reducing the number of residents affected the ability to provide patient services while meeting the teaching and research missions of academic medical centers. Acknowledging the potential for utilization of non-physician providers and house physicians, the GRA document notes that "for 'academic' faculty, the impact of a reduction in residents and fellows may be an increase in patient care responsibilities and less protected time for conducting research."[16]

Even disregarding the potential and significant contributions of non-physician providers, any *increase* in faculty effort would not necessarily be proportionate to the *decrease* in residents' clinical work. Faculty are involved directly in the evaluation of patients, as well as in diagnostic, medical, and operative procedures, in order to assure the quality of care, teach the residents, and meet the supervision requirements of Joint Commission on Accreditation of Healthcare Organizations (JCAHO) and ACGME. Too, some resident work can be reduced or eliminated altogether through improved patient care processes.

Residents and faculty agree that resident clinical assignments are too often based on traditional expectations and the need for "coverage" rather than the educational value of the activity. In the past, these clinical assignments have not been closely scrutinized by external review agencies

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[16] GRA Work Group on GME Sizing, *Reaching Informed Institutional Decisions about Graduate Medical Education Program Size*, AAMC October 1997, p.6.

even when published standards have been articulated. While it would be unrealistic to expect precision, development and/or further refinement of currently available competency standards for each discipline would help program directors understand the amount of clinical exposure that is both appropriate and reasonable for their trainees.

2) **Better information is required on how the integration of education and patient care is affected by financial constraints, hospital accreditation and licensure requirements. The AAMC, including COTH, GRA and Group on Faculty Practice (GFP), should study how these constraints and other factors (broken or outdated computers, faculty lifestyle, unions) impede integration.**

As illustrated by the literature search, no standard instruments exist to quantify residents' efforts. This impedes the measurement and differentiation of professional versus nonprofessional activities, education, and service activities in different training programs and hospital settings. Without standard definition of terms, it's difficult, if not impossible, to compare data from different institutions. Further, outcomes from innovative programs are often reduced to subjective assessments that inevitably lead to the familiar dismissive argument, "That program wouldn't work here."

The same confusion applies to published analyses of the financial consequences of various strategies to replace residents. Costs are expressed in different ways in hospital cost statements and determinations of "lost revenue" from decreased direct and indirect payments for post-graduate training vary in methodology. Impacts on practice plan billings are often not taken into account. "Apples to apples" comparisons would clarify the costs and elucidate the substantial differences in reimbursement for GME activities that depend on state, region or type of hospital.

Nearly all strategies for improving GME require replacing residents with alternative caregivers for some services. Unfortunately, regulatory requirements and restrictions for physician assistants and nurse practitioners vary greatly from state to state. A national comparison of permitted functions for each type of non-physician provider could broaden the consensus of accepted roles for these increasingly important contributors to our health care delivery system. Comparisons with the staffing of hospitals operated without residents may also be instructive.

3) **It is critical to collect data on how residents and faculty spend their time.**

The AAMC should encourage its members to collect data on how residents and attending staff spend their time. The association could facilitate this work by defining categories of activity and designing a data collection methodology.

Most published studies to date have major limitations. Some rely on self-reporting, in which individual residents may or may not be dedicated to accurate accounting. Other, potentially more precise, surveys rely on independent observers who "shadow" residents. Even if the method of recording is optimized, substantial differences remain in how activities are defined, making it difficult to compare studies. Some standardization in collection and organization of such data would make it easier to evaluate efforts to improve the distribution of educational and service time.

4) Innovation in GME should be encouraged.

Funding: Sources of external funding for innovative approaches should be developed from federal and foundation sources. Such funding should support new approaches as well as the assessment and reporting of existing experiments. This work will require a sustained effort by all elements of academic medicine. The rationale is clear; investment in medical education cannot end with the granting of a degree. It is well accepted that professional traits and practices are much more closely modeled during postgraduate training than during the introductory experiences of medical school.

Accreditation: Recently the ACGME has begun to permit and even showcase innovations in resident education. The task force commends these efforts and suggests that the RRCs and ACGME continue to authorize and support promising and responsible pilot programs in residency training. Each specialty should receive independent attention in order to identify ways to accommodate their differences appropriately. Essential to all such efforts is frequent collaborative evaluation by the institutions and RRCs involved, as well as careful longitudinal follow-up of postresidency performance. The ACGME general competencies are stimulating programs and institutional sponsors to assess competencies and study their graduates' performance after completion. The AAMC should help identify and distribute promising developments in GME through special interest groups, the annual meeting, publications and conferences.

Information technology: Development of information systems (IS) to facilitate innovation remains a costly yet critical challenge for teaching hospitals. Even in times of financial hardship, the educational value of these systems should make them a high priority. It is clear that IS can greatly enhance the efficiency of residents and faculty.

In his discussions with the committee, Mark Frisse, M.D., suggested that in the short term computer technology probably cannot do much to solve the problems of work overload, redundant activities, and stress on resident and faculty. Over the next decade, however, Information systems and technological advancements can increase faculty and residents' productivity, enhance educational efficiency and enable the redesign of education and patient care.

For example, faculty could be more productive through billable e-mail communication and automated ordering of tests and pharmaceuticals. Computerized order entry also can be linked to intelligent systems and to education so that both patient care and education are improved. In general, information technology can promote efficient, effective communication between faculty, residents, other caregivers, and patients.

Information technology can "bring knowledge to the bedside," benefiting both education and service. It can make education more productive by providing access to the literature, including a full text digital library and, in particular, "filtered" access to the two or three best articles on a clinical topic. Internet access on the patient floors and in the clinics can speed information retrieval, saving time for residents and attending staff. Interactive learning on the Web and other computer education programs can improve educational efficiency. Journal clubs can be Web or e-mail based. The use of simulators and virtual reality can provide residents with risk-free experience and access to cases rarely encountered in practice.

Information technology can be used to test resident knowledge (e.g., weekly quizzes), score the results and develop standards. It can be used to simulate real-life patient problems and medical procedures, increasing educational efficiency and improving patient safety. It can also help with the administration of GME, including resident procedure logs, assignments and scheduling.

Finally, it can help with the study and analysis needed to restructure education and service. For example, handheld computers can be used to collect data on time use by faculty and residents, which is key information for redesign. It can help analyze patient flows, staffing, costs and revenues, as well as model alternative designs for care delivery and resident education.

While the task force is impressed by the potential for technology to aid the redesign of education and service in academic medical centers, it also recommends caution. We will need careful problem diagnosis to avoid solving the wrong problem with great statistical precision. Solutions will need to be carefully designed to avoid confusing "messing around with toys" with true innovation. Critical evaluation of realistic alternatives and their long-term costs is essential; we need to apply the same critical scrutiny to re-engineering as to the medical literature.

A survey of AAMC members to learn what technological tools they employ in graduate medical education would be valuable. Such a survey might be conducted in collaboration with the American Medical Informatics Association.

5) **The AAMC should promulgate "best practices" for GME administration through case studies of effective institutions. Designated institutional officials for GME should be empowered and should participate meaningfully in institutional priority-setting.**

The administrative structures of university medical centers and other teaching hospitals are highly variable. It would be instructive to better characterize the differing structures and gain insight into the efficiency of administration and satisfaction of those involved (residents, program directors, faculty and hospital administrators). Although it is highly unlikely that an ideal formulation would emerge, we may well learn what successful structures have in common. At the institutional level, the AAMC might encourage making GME directors members of their hospitals' senior administration and exploring ways to make program directors accountable both to their Chair and the institution's GME director. At the program level, the AAMC could support efforts to consolidate institutional responsibility. Finally, an appropriate management structure to ensure advocacy for GME should be required for ACGME institutional approval and receipt of DGME and IME.

Conclusions

In spite of the formidable barriers to change, we anticipate that the next few years will see innovations in resident education and patient care occurring at an increasing pace. The task force notes that the AAMC has a critical role to play in tracking change, fostering the dissemination of information about new approaches, and convening those who are interested in doing things differently.
ACGME, the RRCs and the accreditation process all are critical to encouraging change in both education and patient care. The current initiatives of defining and evaluating educational outcomes have the potential to change radically how residents are educated.

Encouragement for innovation needs to come from Department of Health and Human Services, particularly the Agency for Healthcare Research and Quality, and from the major health care foundations. Change will come faster if funds are directed to support faculty time devoted to re-engineering education and patient care, including design, implementation and evaluation.

The task force believes that clinical faculty members are key to changing resident education. The faculty needs to pay attention to the teaching they do by example. Some may need help developing their teaching skills. They also should receive recognition and career advancement for their work in teaching and curriculum development.

Appendix A
AAMC Annual Meeting Program

Tuesday, October 31, 2000
GRA General Session: Promising Models of Integrating Education and Patient Care

Christine Abrass, M.D., Department of Medicine, University of Washington School of Medicine

Alan Burgener, Moderator

Rosemarie Fisher, M.D., Director of GME, Yale-New Haven Hospital and Department of Internal Medicine, Yale University School of Medicine

Bruce Gewertz, M.D., Chair, Department of Survey, University of Chicago

Donald Girard, M.D., Associate Dean for GME, Oregon Health &Science University

Melissa Melvin, Medical Student, Oregon Health & Science University

Appendix B
Outside Experts Who Met with the Task Force

Charles Bosk, M.D., University of Pennsylvania, author of the book Forgive and Remember, on medical errors in relation to resident education and the acculturation of doctors

Deborah Danoff, M.D., AAMC Division of Education Affairs, on the organization of education and service in Canadian teaching institutions

Mark Frisse, M.D., Express Scripts, formerly of Washington University, on the ways technology might bring education and service into better alignment

David Leach, M.D., Executive Director, Accreditation Council on Graduate Medical Education, on ACGME initiatives and potential areas for collaboration

Kenneth Ludmerer, M.D., Washington University, author of Time to Heal, on the evolution of resident education since World War II and the pressures on academic medicine that are affecting it now

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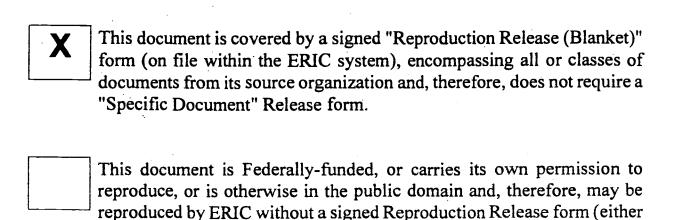Educational Resources Information Center

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