

# The New Paradigm of Continuing Education in Surgery

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Concerns regarding the shortcomings of traditional continuing medical education (CME) have led to widespread acceptance of the concept of continuous professional development (CPD). Continuous professional development focuses on the individual learning needs of physicians across the continuum of their professional careers and encompasses a broad range of educational activities. Continuous professional development activities of practicing surgeons should be integrated with the core competency of practice-based learning and improvement (PBLI), which involves a cycle of 4 steps—identifying areas for improvement, engaging in learning, applying new knowledge and skills to practice, and checking for improvement. The effectiveness of CPD and PBLI should be objectively evaluated by assessing their impact on surgeons' learning and performance and on patient care outcomes. A portfolio may be used to document CPD and PBLI activities and can serve as a valuable learning and assessment tool. It should contain information on the personal learning projects pursued by the surgeon. Continuous professional development of the entire surgical team and education of patients and their families need to be considered within the context of the surgeon's CPD efforts to positively affect patient care. Thus, a concept of global 360° education should be embraced. Continuous professional development integrated with PBLI can help surgeons address their specific learning needs and play a pivotal role in surgeons' providing the best care to patients.

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Colossal changes in health care continue to influence the professional activities of all physicians. The recent intense focus on accountability and patient safety has led to close scrutiny of physicians' competence and performance. The American Board of Medical Specialties has adopted a program of Maintenance of Certification, 2 components of which require practicing physicians to provide (1) evidence of commitment to lifelong learning and involvement in a periodic self-assessment process and (2) evidence of evaluation of performance in practice.<sup>1</sup> The Accreditation Council for Graduate Medical Education and the American Board of Medical Specialties have both defined the same 6 core competencies that every resident must acquire and every prac-

ticing physician must demonstrate.<sup>1,2</sup> These are medical knowledge, patient care, inter-professional and communication skills, professionalism, practice-based learning and improvement (PBLI), and systems-based practice. In my opinion, although all 6 competencies are important throughout the professional careers of individuals, PBLI should be considered the prime competency after residency training. Focus on this competency is key to defining and addressing the educational needs of a practicing physician in all other competency domains.<sup>3</sup>

The relentless changes in health care have resulted in the need for surgeons to continually seek educational opportunities to maintain their competence and to remain competitive. Participation in traditional continuing medical education (CME) has been the principal means by which surgeons acquire knowledge and skills after

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**Table. Key Differences Between Traditional Continuing Medical Education (CME) and Continuous Professional Development (CPD)**

CME	CPD
Episodic interventions designed to address the educational needs of groups of learners	Lifelong learning based on ongoing self-assessments designed to address the educational needs of individuals
Generally teacher centered and teacher driven Principally encompasses the clinical domain	Generally learner centered and learner driven Comprehensive in scope; encompasses the clinical domain, as well as practice management, leadership, administration, education, and an entire spectrum of professional activities
Lecture-based format frequently used in educational activities	A variety of learning formats and media used in educational activities
Most often conducted in formal settings, such as lecture halls or conference rooms	Conducted in a variety of different venues, including locations other than lecture halls and conference rooms

residency training. New educational approaches have been suggested by several national organizations to increase the effectiveness and relevance of continuing education.<sup>4-6</sup> Reports from these organizations have highlighted the need for close collaboration between the boards and respective specialty societies to define the curricular content for continuing education in various specialties; use of continuing education to close the gap between optimal and actual patient care; emphasis on just-in-time learning; role of self-assessment in identifying individual learning needs; use of the best available evidence in education; adoption of a variety of formats to deliver educational content; assessment of change in physicians' practices and patient care outcomes following participation in educational activities; development of the skills of the faculty involved with continuing education; pursuit of research and development to advance the field of continuing education; and linking of continuing education with residency education and medical student education to support the continuum of professional development. The need for change in the metrics used to award credit for participation in continuing education has also been articulated. The concept of continuous professional development (CPD) helps to address many of these recommendations.

### CONCEPT OF CPD

Concerns regarding shortcomings of traditional CME have led to widespread acceptance of the concept of CPD.<sup>7</sup> Continuous professional development emphasizes ongoing professional development of individuals across the continuum of their careers. Continuous professional development relies on self-assessments to identify specific learning needs; it is learner centered and self-directed. Thus, the learner plays a pivotal role in his or her own education. Continuous professional development is more holistic compared with traditional CME; it is comprehensive in scope and extends beyond the clinical domain. Educational activities aimed at CPD may focus on practice management, leadership, administration, education, and an entire spectrum of professional activities of physicians. A variety of learning formats and different types of media are useful in implementing the educational activities. Continuous professional development activities may be conducted in venues other than lec-

ture halls or conference rooms. The key differences between traditional CME and CPD are listed in the **Table**.

Other key principles also need to be considered within the context of CPD for surgeons. Emphasis should be placed on supporting surgeons' efforts to achieve the requisite levels of competence and performance, and not on punitive measures to address gaps in competence and performance. Continuous professional development is best pursued through education that is contextually relevant to the surgeon's practice. Although national meetings remain the principal venue for the provision of educational content, regional and local sites need to be considered for implementation of educational programs to facilitate participation by surgeons. Regional efforts may be pursued through education centers that are especially accredited to offer continuing education programs. Educational programs may be made available locally at practice locations using the Internet, CD-ROMs, printed materials, and other distance education methods. Frequent low-stakes assessments that are coupled with specific and meaningful feedback should be the hallmark of activities aimed at CPD. The special characteristics of CPD mentioned above make it appealing as the principal educational approach to support the professional aspirations and activities of surgeons.

### INTEGRATION OF CPD WITH PBLI

Continuous professional development activities of practicing surgeons should be integrated with the core competency of PBLI. Efforts directed at PBLI can help to define gaps in performance. These gaps may be addressed through CPD and the outcomes reassessed using the PBLI process. The cycle of PBLI involves the following 4 major steps: identifying areas for improvement, engaging in learning, applying new knowledge and skills to practice, and checking for improvement. Each surgeon needs to regularly pursue PBLI by participating in this cycle to continually improve performance.

### IDENTIFYING AREAS FOR IMPROVEMENT

The first step in the PBLI cycle involves identifying areas for improvement. Self-assessment and reflection are pivotal in assessing specific learning needs. Several activi-

ties may help in defining educational needs in various core competency domains. These include reviewing the current literature, considering practice guidelines, and seeking expert opinions. Horizon scanning for new procedures and emerging technologies can help to determine whether a procedure or technology is appropriate to include in the surgeon's practice. This decision should be based on individual practice patterns, availability of resources and support systems, and needs of the patients served. Ongoing assessment of clinical outcomes and comparing these outcomes with national, regional, or local data are key to identifying areas for improvement. Although risk-adjusted patient outcomes data are needed for valid and reliable comparisons, such data distilled down to the individual surgeon's level are presently unavailable. Thus, gross comparisons with national, regional, or local data need to be made for educational purposes. Systems for collecting and analyzing a surgeon's practice outcomes data through use of personal digital assistants and the Internet can be helpful. This process needs to be integrated with the routine clinical information management activities of surgeons to avoid duplication of effort. Surgeons may need guidance in assessing their learning needs using the aforementioned approaches.

#### ENGAGING IN LEARNING

Once the surgeon has identified his or her own specific learning needs, the next step in the PBLI cycle is selection of and participation in an appropriate educational activity. During selection of educational opportunities, the surgeon needs to compare his or her learning needs with the goals and objectives of the available educational activities to ascertain congruence. The process needs to consider not just the educational content but also the anticipated outcomes. The surgeon will be well served if he or she remembers that although the stated learning objectives of a program help to guide learning, they do not account for all the learning and behavioral change that may follow.<sup>8</sup> Unanticipated learning outcomes occur quite often and these may be of great benefit to learners.

Motivation and intrinsic drive of adult learners encourage them to pursue educational opportunities.<sup>9</sup> The motivation of learners is increased if the educational activity is perceived to be relevant to the learner's work. A specific patient problem serves as a great impetus for a surgeon to seek further information or education. Ongoing educational activities that are directly related to patient care are likely to be more effective than episodic educational activities presented in isolation. Just-in-time CPD that is related to patient care underscores the relevance of the educational activity and allows the surgeon to immediately apply the new knowledge or skill to practice. The surgeon should assess the potential of the educational activity to change his or her practice. Because radical changes in established routines are difficult to implement, an educational activity that is likely to result in incremental change is preferred.

Experiences in effective educational approaches from various medical disciplines need to be adopted in surgery. Research in continuing education has revealed that

traditional didactic educational programs offered in formal settings using a teacher-centered format are not as effective in changing physicians' practices and affecting patient outcomes as are interactive sessions that involve learner-centered approaches.<sup>10-12</sup> The interactive techniques may include large and small group exercises, case discussions, role play, and a host of other methods. Also, sequenced continuing education programs seem to result in greater influence on physicians' performance compared with single interventions. A sequenced program allows the learner to apply the new knowledge and skills to practice and then return for the next session to build on this experience.

Other effective educational approaches include use of academic detailing, opinion leaders and learning communities, and audit of practice and feedback.<sup>11,13-16</sup> Academic detailing involves experts who work individually with physicians to promote the desired change in practices. Opinion leaders may influence changes among groups of physicians through regular meetings and discussions.<sup>17</sup> This process can create active and supportive learning communities.<sup>18</sup> Practice audits coupled with feedback are helpful in providing specific information that is directly related to the physician's practice.

Despite the shortcomings of traditional didactic CME activities, they continue to remain popular.<sup>19</sup> Physicians attend these activities to obtain information or get updated, to be assured that their practices are within accepted guidelines, and to interact with experts.<sup>20</sup> Traditional CME activities may also enhance the confidence of learners, stimulate their interest in the subject, and predispose them to participate in other educational activities that will help in changing practices. Thus, certain traditional CME activities may be included in educational efforts designed to address the learning needs of individual surgeons.

In regard to acquisition of skills to perform new procedures or to use emerging technologies, the surgeon needs to select an appropriate educational program using a disease-based approach rather than a technology-driven approach. A complete educational experience, including a period of structured preceptoring following a course, is necessary to ensure the safe transfer of the newly acquired skill to practice. Acquisition of skill should progress through the 3 stages of cognition, integration, and autonomous learning.<sup>21</sup> Representative tasks within a technical skill should be identified and addressed through specific educational interventions. Expertise develops as a result of deliberate practice coupled with specific, timely feedback and from avoidance of automaticity through establishment of learning goals that exceed existing levels of performance.<sup>22</sup> In addition, learner motivation, accurate self-assessment, reflection, metacognition, and minimum exposure to error-prone alternatives are all important in developing expertise. The knowledge and skills of surgeons should be verified and documented at the completion of the course and preceptorial experience.

Surgeons may face major hurdles in their attempts to select and participate in educational opportunities to address their individual learning needs.<sup>23</sup> Difficulties in locating complete educational programs that include struc-

tured preceptorship following a course can be challenging. Also, problems associated with taking time away from busy practices to participate in an educational program may discourage participation. Thus, steps need to be taken to address these challenges and difficulties.

Skills courses may be offered at regional sites, such as accredited education centers. Certain educational materials and assignments may be made available to learners at their practice locations before and after courses. The Internet can be useful in the provision of such educational resources. Research has revealed that participation in Internet-based education can increase physicians' knowledge and help in changing practices.<sup>24</sup> Several factors encourage physicians to seek educational information on the Internet. These are credibility of the source, relevance of the material, unlimited access, speed, and ease of use.<sup>25</sup> On the other hand, too much information, lack of specific information, and difficulties in navigating and searching for educational content can discourage physicians from using the Internet. Case-based educational formats are generally preferred over text-based materials. The quality of the content has been found to be of most importance to physicians and too little interaction the greatest source of dissatisfaction.<sup>24</sup> Internet-based educational programs in surgery need to be designed based on this information. Advances in technology will facilitate delivery of multimedia programs of greater complexity and interactivity to surgeons in the future.

#### APPLYING NEW KNOWLEDGE AND SKILLS TO PRACTICE

Several factors need to be considered regarding application of new knowledge and skills to practice. Insights into one's performance and motivation to change one's practice are pivotal.<sup>26</sup> Also, if a physician perceives urgency in translating new knowledge to practice and there is sufficient certainty regarding the clinical situation that requires use of the knowledge, he or she is likely to apply the knowledge to practice.<sup>27</sup> Enabling methods, such as educational materials that facilitate application of the new knowledge and skills and reminders, are important in changing practices. Also, change in a physician's practice may be encouraged through reinforcing strategies.<sup>28</sup> Internet-based educational programs, academic detailing, and opinion leaders can be of great help in this regard. A number of the aforementioned approaches used in combination are more likely to motivate a surgeon to make changes in his or her practice than is a single approach.

Following participation in a course, a period of structured preceptorship is critical to safely apply the new skill to practice. Several models of preceptorship may be considered. The preceptor may work with their learner at the learner's institution; the learner may work with the preceptor at the preceptor's institution; or the learner may participate in a structured experience over a period of time at the preceptor's institution (a mini-fellowship).<sup>21</sup> Each model has certain advantages and disadvantages. Preceptorial support may be offered regionally by the accredited education centers to surgeons following participation in courses.

#### CHECKING FOR IMPROVEMENT

The impact of CPD and PBLI activities on surgeons' learning, surgeons' performance, and patient care outcomes needs to be evaluated through valid and reliable assessment methods. Such evaluation should be an integral part of the educational model. Cognitive knowledge may be assessed through the use of multiple-choice examinations and computer-based cases. Skills should ideally be verified through direct observation in simulated settings. Detailed and specific feedback based on these assessments needs to be provided to surgeons to support learning.

Assessment of a surgeon's performance in real settings is important, but remains a daunting task. Subjective information from physicians regarding changes they have made in their practices following participation in educational activities is insufficient to assess the effect of the activities. Practice audits through medical record reviews are frequently used to assess the performance of physicians. Other assessment tools include 360° evaluations, which provide information on physicians' performance based on assessments by peers and other health care professionals. Patient surveys are helpful in assessing communication skills and professionalism. Direct observation of performance by an expert is desirable but presents a host of logistical challenges. Review of videotapes of operations by blinded experts is more convenient to implement but provides information on only certain aspects of surgical skills.

Because of the difficulties associated with assessing a surgeon's performance, patient care outcomes are often used as a proxy for assessment of performance. However, many confounding variables affect patient care outcomes and need to be considered. Ideally, risk-adjusted patient outcomes should be assessed to evaluate the impact of CPD and PBLI activities on patient care. Because of the unavailability to date of individually focused risk-adjusted patient outcomes data for comparison, data that are not risk adjusted may need to be used. Although the aforementioned approaches can help in assessing performance, certain limitations must be noted. Improvement in outcomes is, at times, too small to be noted by the assessment methods used and the performance may reach a ceiling effect if the baseline level is high.<sup>11</sup>

#### DOCUMENTATION OF CPD AND PBLI ACTIVITIES

Continuous professional development and PBLI activities are best documented using a portfolio-based approach. A portfolio is a structured and highly individualized learning and criterion-referenced assessment tool.<sup>3,29,30</sup> It includes information on both the learning processes and the outcomes relating to each step in the PBLI cycle. Evidence-based information used by the learner in personal learning projects should be noted in the portfolio. Also, the processes used to pursue education, including reflection and metacognition, need to be documented. The portfolio should contain information on the personal learning projects pursued by the surgeon within the context of PBLI. Personal learning projects involve

activities pursued by a surgeon to address his or her specific learning needs.<sup>31</sup> State-of-the-art technology that includes use of personal digital assistants and the Internet can be helpful in preparing and maintaining a portfolio. Evaluation of the portfolio should include assessment of the learning processes as well as their effect on the surgeon's competence and performance. Assessment of the portfolio may be conducted by peers or external reviewers based on clearly established criteria.

#### RELATIONSHIP OF CPD, PBLI, AND OTHER ACTIVITIES OF THE SURGERY DEPARTMENT AND INSTITUTION

Continuous professional development that is integrated with PBLI efforts should result in a positive effect on patient care. Thus, it can play a critical role in the quality improvement activities of a surgery department or an institution. Quality improvement data, including information on patient care outcomes and patient feedback, yield valuable information that may be used to identify learning needs within the context of CPD. Also, such data may be used to assess the impact of CPD and PBLI activities on patient care.

Because the surgeon does not work in isolation, CPD efforts pursued by other members of the surgical team also affect patient care outcomes. Thus, the learning needs of all members of the surgical team should be carefully considered and adequately addressed. In addition to addressing educational needs of individuals, team training is critical to ensure provision of safe and effective health care. Education of patients also plays a critical role in ensuring optimum patient care outcomes. Information provided to patients using traditional approaches may be insufficient to prepare them for surgery, or for patients and their families to take care of various health care needs following surgery. Patient education efforts must be aimed at changing behaviors and not just enhancing comprehension. Education principles used to support CPD of surgeons should be used also to address educational needs of patients and their families. Thus, I propose the concept of 360° education involving the surgeon, other members of the surgical team, patients, and patients' families.

#### ROLE OF PROFESSIONAL SOCIETIES IN SUPPORTING CPD AND PBLI

Specialty societies must play a key role in supporting the CPD and PBLI efforts of physicians. The American College of Surgeons, through its Division of Education, is pursuing a spectrum of activities to help surgeons with their CPD and PBLI efforts. All 6 core competency domains are being addressed using contemporary and innovative approaches.

A range of educational programs is offered by the college's Division of Education to address knowledge and skills. Changes have been made in existing programs, new programs have been added, and greater interactivity has been introduced in programs to enhance effectiveness. The highly regarded Surgical Education and Self-Assessment Program is especially designed to address the cognitive domain and covers a variety of surgical topics.

Several sessions from the Clinical Congresses and Spring Meetings of the college have been made available to surgeons on the Internet for online category 1 CME credit. The division is also working on designing mechanisms that will help surgeons access educational programs through the American College of Surgeons' Web Portal, which is being developed.

The repertoire of skills courses has been expanded to address knowledge and skills relating to a variety of new procedures and emerging technologies. Such procedures and technologies are identified through ongoing horizon scanning. Didactic course materials for several courses have been made available on CD-ROMs to facilitate access. The division is pursuing use of reliable and valid methods to assess acquisition of knowledge and skills following participation in courses. This should yield valuable information regarding the effect of educational activities.

The division is considering a variety of reinforcing strategies following participation in courses. Many of these will involve delivery of educational materials through the Internet. Various options to offer preceptorship following participation in courses are being explored. Establishment of a network of surgical education centers accredited by the American College of Surgeons would be key to offering educational programs, including skills courses, and to supporting preceptorship. A model for such accreditation is being developed through efforts of the Division of Education. The centers should also be of great help in establishing local and regional learning communities and peer-support systems to support PBLI.

Four education task forces are specifically addressing the competencies of interpersonal and communication skills, professionalism, PBLI, and systems-based practice. Several educational programs and products are being produced by these task forces for use across all surgical specialties. The PBLI task force is designing a personal digital assistant and Internet-based program to help surgeons monitor their outcomes and is exploring opportunities to provide comparative data to assist surgeons in conducting gap analyses and defining specific learning needs. The program should support surgeons' efforts to select CPD activities and assess their impact. This will complete the cycle of PBLI because the gaps identified would serve as a needs assessment for further education.

#### FACULTY DEVELOPMENT TO SUPPORT EDUCATIONAL ACTIVITIES AIMED AT CPD AND PBLI

Faculty members responsible for designing and implementing activities directed at CPD and PBLI may require special training in new approaches in continuing education. Special emphasis will need to be placed on educational interventions that are likely to change surgeons' practices and positively affect patient outcomes. Faculty development activities should address skills across the entire spectrum of educational efforts, including needs assessments, curriculum design, effective teaching, and valid and reliable evaluation of learners and the programs. Educators involved with CPD should possess cer-

tain important competencies.<sup>32</sup> They should be able to guide learning, use effective educational strategies to achieve optimum results, assess outcomes of educational activities, link educational efforts of physicians with patient and public education, pursue research to advance the field of continuing education, and disseminate information on new health care practices. Dissemination of information regarding innovative CPD methods will be paramount in facilitating global educational change.

## CONCLUSIONS

Concerns about traditional CME have resulted in wide acceptance of the concept of CPD, which involves focus on the individual learning needs of physicians across the continuum of their careers. Continuous professional development for surgeons needs to be performance-driven and should be linked to PBLI. The PBLI process involves a cycle of 4 steps—identifying areas for improvement based on self-assessment; engaging in learning; applying new knowledge and skills to practice; and checking for improvement. Continuous professional development and PBLI activities should be documented through the use of portfolios, which can serve as valuable learning and assessment tools. The educational needs of other members of the surgical team, the patients, and patients' families should also be considered within the context of CPD for surgeons. Thus, a concept of 360° education should be embraced. Continuous professional development activities need to be linked with the overall quality improvement endeavors of the department of surgery and the institution. The skills of educators involved with continuing education efforts may need to be enhanced to provide appropriate support for such activities. Relevant and effective CPD that is closely linked to PBLI is key to surgeons' achieving their individual professional goals and providing the best care to patients.

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## REFERENCES

- Nahrwold DL. The competence movement: a report on the activities of the American Board of Medical Specialties. *Bull Am Coll Surg*. 2000;85:14-18.
- Accreditation Council for Graduate Medical Education Outcome Project. General competencies. Available at: <http://www.acgme.org/outcome/comp/compFull.asp>. Accessed November 11, 2004.
- Sachdeva AK. Acquisition and maintenance of surgical competence. *Semin Vasc Surg*. 2002;15:182-190.
- Holzman G, Alden E, Dworkin H, et al. *Repositioning for the Future of Continuing Medical Education*. Lake Bluff, Ill: Council of Medical Specialty Societies; 2002. Position paper.
- Lane D, Alden E, Koeppen B, Sachdeva AK. *Competency and the Continuum: A Report From the ACCME Task Force*. Chicago, Ill: Accreditation Council for Continuing Medical Education; 2003.
- Martin JB, Alpern RJ, Betz AL, et al. *Educating Doctors to Provide High Quality Medical Care: A Vision for Medical Education in the United States*. Washington, DC: Association of American Medical Colleges; 2004. Report of the Ad Hoc Committee of Deans.
- Davis D, Fox R, Barnes BE. The horizon of continuing professional development: five questions in knowledge translation. In: Davis D, Barnes BE, Fox R, eds. *The Continuing Professional Development of Physicians: From Research to Practice*. Chicago, Ill: AMA Press; 2003:9-24.
- Dolcourt JL, Zuckerman G. Unanticipated learning outcomes associated with commitment to change in continuing medical education. *J Contin Educ Health Prof*. 2003;23:173-181.
- Knowles M. *The Adult Learner: A Neglected Species*. 4th ed. Houston, Tex: Gulf Publishing Co; 1990.
- Davis D, Thomson O'Brien MA, Freemantle N, Wolf FM, Mazmanian P, Taylor-Vaisey A. Impact of formal continuing medical education: do conferences, workshops, rounds, and other traditional continuing education activities change physician behavior or health care outcomes? *JAMA*. 1999;282:867-874.
- Grant J, Stanton F. *The Effectiveness of Continuing Professional Development: A Report for the Chief Medical Officer's Review of Continuing Professional Development in Practice*. Edinburgh, Scotland: Association for the Study of Medical Education; 2000.
- Robertson MK, Umble KE, Cervero RM. Impact studies in continuing education for health professions: update. *J Contin Educ Health Prof*. 2003;23:146-156.
- Davis DA, Thomson MA, Oxman AD, Haynes RB. Changing physician performance: a systematic review of the effect of continuing medical education strategies. *JAMA*. 1995;274:700-705.
- Mazmanian PE, Davis DA. Continuing medical education and the physician as a learner: guide to the evidence. *JAMA*. 2002;288:1057-1060.
- Cauffman JG, Forsyth RA, Clark VA, et al. Randomized controlled trials of continuing medical education: what makes them most effective? *J Contin Educ Health Prof*. 2002;22:214-221.
- Landry MD, Sibbald WJ. Changing physician behavior: a review of patient safety in critical care medicine. *J Crit Care*. 2002;17:138-145.
- Pereles L, Lockyer J, Ryan D, Davis D, Spivak B, Robinson B. The use of the opinion leader in continuing medical education. *Med Teach*. 2003;25:438-441.
- Parboosingh J. Continuing education and professional development for hospital doctors and dentists. *Med Educ*. 2000;34:421-423.
- McLeod PJ, McLeod AH. If formal CME is ineffective, why do physicians still participate? *Med Teach*. 2004;26:184-186.
- Harrison C, Hogg W. Why do doctors attend traditional CME events if they don't change what they do in their surgeries? evaluation of doctors' reasons for attending a traditional CME programme. *Med Educ*. 2003;37:884-888.
- Sachdeva AK. Acquiring skills in new procedures and technology: the challenge and the opportunity. *Arch Surg*. In press.
- Ericsson KA. Deliberate practice and the acquisition and maintenance of expert performance in medicine and related domains. *Acad Med*. 2004;79(suppl):S70-S81.
- Sachdeva AK. Invited commentary: educational interventions to address the core competencies in surgery. *Surgery*. 2004;135:43-47.
- Casebeer L, Kristofco RE, Strasser S, et al. Standardizing evaluation of on-line continuing medical education: physician knowledge, attitudes, and reflection on practice. *J Contin Educ Health Prof*. 2004;24:68-75.
- Bennett NL, Casebeer LL, Kristofco RE, Strasser SM. Physicians' Internet information-seeking behaviors. *J Contin Educ Health Prof*. 2004;24:31-38.
- Hays RB, Jolly BC, Caldon LJ, et al. Is insight important? measuring capacity to change performance. *Med Educ*. 2002;36:965-971.
- Kennedy T, Regehr G, Rosenfield J, Roberts SW, Lingard L. Exploring the gap between knowledge and behavior: a qualitative study of clinical action following an educational intervention. *Acad Med*. 2004;79:386-393.
- Goodyear-Smith F, Whitehorn M, McCormick R. General practitioners' perceptions of continuing medical education's role in changing behavior. *Educ Health Prof*. 2003;16:328-338.
- Challis M. AMEE medical education guide no. 11 (revised): portfolio-based learning and assessment in medical education. *Med Teach*. 1999;21:370-386.
- Mathers NJ, Challis MC, Howe AC, Field NJ. Portfolios in continuing medical education—effective and efficient? *Med Educ*. 1999;33:521-530.
- Parboosingh J, Thivierge R, Samson L. Practice-based learning and improvement: a practical approach to knowledge translation. In: Proceedings of the 23rd International Congress of Radiology; June 25-29, 2004; Montreal, Canada.
- Bennett NL, Davis DA, Easterling WE Jr, et al. Continuing medical education: a new vision of professional development of physicians. *Acad Med*. 2000;75:1167-1172.