

MEDCHI, THE MARYLAND STATE MEDICAL SOCIETY  
HOUSE OF DELEGATES

Resolution 6-18

INTRODUCED BY: Medical Student Section

SUBJECT: Emerging Technologies (Robotics and AI) in Medical School Education

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Whereas, A host of novel technologies are revolutionizing the nature of healthcare delivery, notably including, but not limited to, machine learning<sup>1</sup>, surgical robotics<sup>2</sup>, high-throughput sequencing<sup>3</sup>, and virtual reality<sup>4</sup>; and

Whereas, There have been significant advancements to image recognition technology using deep neural networks, a machine learning method that has been applied to a variety of consumer applications and social networks<sup>5</sup>; and

Whereas, These image recognition technologies have been demonstrated to be effective for medical applications<sup>1</sup>; and

Whereas, The advent of high-throughput sequencing technologies in the past decade has facilitated an explosion of genetic data, including DNA and RNA sequencing technologies<sup>3</sup>, and related techniques to conduct genome-wide assays of regulatory protein activity and chromatin accessibility to develop novel gene therapies<sup>6</sup>; and

Whereas, Robot-assisted surgery presents an opportunity to enable wider access to surgical procedures across the world through a reduction in cost and training<sup>2</sup>, and doctors training to be surgeons should be prepared to learn the techniques that complement the machines, and thus deliver the best care to patients; and

Whereas, It is highly likely that the nature of the careers of most medical students beginning today will be entangled with machine learning technologies such as deep learning technologies used today to identify cancerous cells<sup>7</sup>, and thus understanding their high-level uses and limitations is critical to being able to deploy treatments involving machine learning in a manner that optimizes the care given to patients; and

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<sup>1</sup> Gulshan V, Peng L, Coram M, et al. Development and validation of a deep learning algorithm for detection of diabetic retinopathy in retinal fundus photographs. *JAMA*, 2016;316(22),2402-2410.

<sup>2</sup> Simonite T. The Recipe for the Perfect Robot Surgeon. *MIT Technology Review*, 2016.

<sup>3</sup> Goodwin S, McPherson JD, McCombie WR. Coming of age: ten years of next-generation sequencing technologies. *Nature Reviews Genetics*. 2016;17(6),333-351.

<sup>4</sup> Holland TM. Five Ways Medical Virtual Reality Helps Train Future Physicians. *Samsung Insights*. 2016.

<sup>5</sup> LeCun Y, Bengio Y, Hinton G. Deep learning. *Nature*. 2015;521.7553, 436-444.

<sup>6</sup> Zeng H., Edwards, M. D., Liu, G., & Gifford, D. K. (2016). Convolutional neural network architectures for predicting DNA-protein binding. *Bioinformatics*, 32(12), i121-i127.]

<sup>7</sup> Mukherjee S. A.I. Versus M.D.: What happens when diagnosis is automated? *The New Yorker*, 2017.

Whereas, These technologies require specialized training to understand their value and limitations with respect to healthcare delivery; and

Whereas, Partnerships with technology companies already exist in medical school environments<sup>8</sup>, thus providing a basis for expanded training programs in future technologies; and

Whereas, AMA policy (H-295.995) states that students should be educated in an increased breadth of clinical knowledge and the AMA MSS (295.044MSS) recognizes the future of medicine as an important educational goal for medical students; therefore be it

Whereas, Preparation of medical students and physicians for these transformations in healthcare delivery will reduce associated risks<sup>9</sup> by preventing AI and machine learning from outpacing human understanding; and

Whereas, The automation and increased efficiency of documentation will empower physicians and healthcare professionals to focus on empathy, compassion, and actual time spent with patients<sup>11</sup>; and

Resolved, That MedChi ask our AMA to encourage medical schools to evaluate and update as appropriate their curriculum to increase students' exposure to emerging technologies, in particular those related to robotics and artificial intelligence; and be it further

Resolved, That MedChi ask our AMA to encourage medical schools to provide student access to computational resources like cloud computing services; and be it further

Resolved, That MedChi ask our AMA to reaffirms H-480.988 which urges physicians to continue to ensure that, for every patient, technologies will be utilized in the safest and most effective manner by health care professionals; and be it further

Resolved, That MedChi ask our AMA to reaffirm Section 1.2.11 of the AMA Code of Ethics and H-480.996 that states the guidelines for the ethical development of medical technology and innovation in healthcare.

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As adopted by the House of Delegates at its meeting on April 29, 2018.

**RELEVANT AMA AND AMA-MSS POLICY:**

Recommendations for Future Directions for Medical Education H-295.995

Our AMA supports the following recommendations relating to the future directions for medical education: (1) The medical profession and those responsible for medical education should strengthen the general or broad components of both undergraduate and graduate medical education. All medical students and resident physicians should have general knowledge of the whole field of medicine regardless of their projected choice of specialty. (2) Schools of medicine should accept the principle and should state in their requirements for admission that a broad cultural education in the arts, humanities, and social sciences, as well as in the biological and physical sciences, is desirable. (3) Medical schools should make their goals and objectives known to prospective students and premedical counselors in order that applicants may apply to medical schools whose programs are most in accord with their career goals. (4) Medical schools should state explicitly in publications their admission requirements and the methods they employ in the

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<sup>8</sup> White T. Stanford Launches digital health center to connect faculty with tech companies. *Stanford Medicine News Center*, 2017.

<sup>9</sup> Meskó B. *The Guide to the Future of Medicine: Technology and The Human Touch*. 2nd ed. Webicina Kft; 2017.

selection of students. (5) Medical schools should require their admissions committees to make every effort to determine that the students admitted possess integrity as well as the ability to acquire the knowledge and skills required of a physician. (6) Although the results of standardized admission testing may be an important predictor of the ability of students to complete courses in the preclinical sciences successfully, medical schools should utilize such tests as only one of several criteria for the selection of students. Continuing review of admission tests is encouraged because the subject content of such examinations has an influence on premedical education and counseling. (7) Medical schools should improve their liaison with college counselors so that potential medical students can be given early and effective advice. The resources of regional and national organizations can be useful in developing this communication. (8) Medical schools are chartered for the unique purpose of educating students to become physicians and should not assume obligations that would significantly compromise this purpose. (9) Medical schools should inform the public that, although they have a unique capability to identify the changing medical needs of society and to propose responses to them, they are only one of the elements of society that may be involved in responding. Medical schools should continue to identify social problems related to health and should continue to recommend solutions. (10) Medical school faculties should continue to exercise prudent judgment in adjusting educational programs in response to social change and societal needs. (11) Faculties should continue to evaluate curricula periodically as a means of ensuring that graduates will have the capability to recognize the diverse nature of disease, and the potential to provide preventive and comprehensive medical care. Medical schools, within the framework of their respective institutional goals and regardless of the organizational structure of the faculty, should provide a broad general education in both basic sciences and the art and science of clinical medicine. (12) The curriculum of a medical school should be designed to provide students with experience in clinical medicine ranging from primary to tertiary care in a variety of inpatient and outpatient settings, such as university hospitals, community hospitals, and other health care facilities. Medical schools should establish standards and apply them to all components of the clinical educational program regardless of where they are conducted. Regular evaluation of the quality of each experience and its contribution to the total program should be conducted. (13) Faculties of medical schools have the responsibility to evaluate the cognitive abilities of their students. Extramural examinations may be used for this purpose, but never as the sole criterion for promotion or graduation of a student. (14) As part of the responsibility for granting the MD degree, faculties of medical schools have the obligation to evaluate as thoroughly as possible the non-cognitive abilities of their medical students. (15) Medical schools and residency programs should continue to recognize that the instruction provided by volunteer and part-time members of the faculty and the use of facilities in which they practice make important contributions to the education of medical students and resident physicians. Development of means by which the volunteer and part-time faculty can express their professional viewpoints regarding the educational environment and curriculum should be encouraged. (16) Each medical school should establish, or review already established, criteria for the initial appointment, continuation of appointment, and promotion of all categories of faculty. Regular evaluation of the contribution of all faculty members should be conducted in accordance with institutional policy and practice. (17a) Faculties of medical schools should reevaluate the current elements of their fourth or final year with the intent of increasing the breadth of clinical experience through a more formal structure and improved faculty counseling. An appropriate number of electives or selected options should be included. (17b) Counseling of medical students by faculty and others should be directed toward increasing the breadth of clinical experience. Students should be encouraged to choose experience in disciplines that will not be an integral part of their projected graduate medical education. (18) Directors of residency programs should not permit medical students to make commitments to a residency program prior to the final year of medical school. (19) The first year of postdoctoral medical education for all graduates should consist of a broad year of general training. (a) For Physicians entering residencies in internal medicine, pediatrics, and general surgery, postdoctoral medical education should include at least four months of training in a specialty or specialties other than the one in which the resident has been appointed. (A residency in family practice provides a broad education in medicine because it includes training in several fields.) (b) For physicians entering residencies in specialties other than internal medicine, pediatrics, general surgery, and family practice, the first postdoctoral year of medical education should be devoted to one of the four above-named specialties or to a program following the general requirements of a transitional year stipulated in the "General Requirements" section of the "Essentials of Accredited Residencies." (c) A program for the transitional year should be planned, designed, administered, conducted, and evaluated as an entity by the sponsoring institution rather than one or more departments. Responsibility for the executive direction of the program should be assigned to one physician whose responsibility is the administration of the program. Educational programs for a transitional year should be subjected to thorough surveillance by the appropriate accrediting body as a means of assuring that the content, conduct, and internal evaluation of the educational program conform to national standards. The impact of the transitional year should not be deleterious to the educational programs of the specialty disciplines. (20) The ACGME, individual specialty boards, and respective residency review committees should improve communication with directors of residency programs because of their shared responsibility for programs in graduate medical education. (21) Specialty boards should be aware of and concerned with the impact that the requirements for certification and the content of the examination have upon the content and structure of graduate medical education. Requirements for certification should not be so specific

that they inhibit program directors from exercising judgment and flexibility in the design and operation of their programs. (22) An essential goal of a specialty board should be to determine that the standards that it has set for certification continue to assure that successful candidates possess the knowledge, skills, and the commitment to upgrade continually the quality of medical care. (23) Specialty boards should endeavor to develop a consensus concerning the significance of certification by specialty and publicize it so that the purposes and limitations of certification can be clearly understood by the profession and the public. (24) The importance of certification by specialty boards requires that communication be improved between the specialty boards and the medical profession as a whole, particularly between the boards and their sponsoring, nominating, or constituent organizations and also between the boards and their diplomates. (25) Specialty boards should consider having members of the public participate in appropriate board activities. (26) Specialty boards should consider having physicians and other professionals from related disciplines participate in board activities. (27) The AMA recommends to state licensing authorities that they require individual applicants, to be eligible to be licensed to practice medicine, to possess the degree of Doctor of Medicine or its equivalent from a school or program that meets the standards of the LCME or accredited by the American Osteopathic Association, or to demonstrate as individuals, comparable academic and personal achievements. All applicants for full and unrestricted licensure should provide evidence of the satisfactory completion of at least one year of an accredited program of graduate medical education in the US. Satisfactory completion should be based upon an assessment of the applicant's knowledge, problem-solving ability, and clinical skills in the general field of medicine. The AMA recommends to legislatures and governmental regulatory authorities that they not impose requirements for licensure that are so specific that they restrict the responsibility of medical educators to determine the content of undergraduate and graduate medical education. (28) The medical profession should continue to encourage participation in continuing medical education related to the physician's professional needs and activities. Efforts to evaluate the effectiveness of such education should be continued. (29) The medical profession and the public should recognize the difficulties related to an objective and valid assessment of clinical performance. Research efforts to improve existing methods of evaluation and to develop new methods having an acceptable degree of reliability and validity should be supported. (30) U.S. citizens should have access to factual information on the requirements for licensure and for reciprocity in the various jurisdictions, prerequisites for entry into graduate medical education programs, and other factors that should be considered before deciding to undertake the study of medicine in schools not accredited by the LCME. (31) Policies governing the accreditation of U.S. medical education programs specify that core clinical training be provided by the parent medical school; consequently, the AMA strongly objects to the practice of substituting clinical experiences provided by U.S. institutions for core clinical curriculum of foreign medical schools. Moreover, it strongly disapproves of the placement of any medical school undergraduate students in hospitals and other medical care delivery facilities which lack educational resources and experience for supervised teaching of clinical medicine. (32) Methods currently being used to evaluate the readiness of graduates of foreign medical schools to enter accredited programs in graduate medical education in this country should be critically reviewed and modified as necessary. No graduate of any medical school should be admitted to or continued in a residency program if his or her participation can reasonably be expected to affect adversely the quality of patient care or to jeopardize the quality of the educational experiences of other residents or of students in educational programs within the hospital. (33) The Educational Commission for Foreign Medical Graduates should be encouraged to study the feasibility of including in its procedures for certification of graduates of foreign medical schools a period of observation adequate for the evaluation of clinical skills and the application of knowledge to clinical problems. (34) The AMA, in cooperation with others, supports continued efforts to review and define standards for medical education at all levels. The AMA supports continued participation in the evaluation and accreditation of medical education at all levels. (35) The AMA, when appropriate, supports the use of selected consultants from the public and from the professions for consideration of special issues related to medical education. (36) The AMA encourages entities that profile physicians to provide them with feedback on their performance and with access to education to assist them in meeting norms of practice; and supports the creation of experiences across the continuum of medical education designed to teach about the process of physician profiling and about the principles of utilization review/quality assurance. (37) Our AMA encourages the accrediting bodies for MD- and DO-granting medical schools to review, on an ongoing basis, their accreditation standards to assure that they protect the quality and integrity of medical education in the context of the emergence of new models of medical school organization and governance.

Effective Education for the Future of Medicine 295.044MSS

Effective Education for the Future of Medicine: The AMA-MSS Governing Council will continue to identify opportunities to present timely and relevant health policy information to medical students.

Support of Business of Medicine Education for Medical Students 295.115MSS

Our AMA will encourage all US medical schools to provide students with a basic foundation in medical business,

drawing upon curricular domains referenced in Undergraduate Medical Education for the 21st Century (UME-21), in order to assist students in fulfilling their professional obligation to patients and society in an efficient, ethical, and cost-effective manner.

#### Educating Medical Students about the Pharmaceutical Industry 295.130MSS

AMA-MSS will ask the AMA to: (1) strongly encourage medical schools to include unbiased curricula concerning the impact of direct-to-consumer marketing practice employed by the pharmaceutical industry, as they relate to the physician-patient relationship; and (2) strongly encourage medical schools to include unbiased information in their curricula concerning the pharmaceutical industry regarding (a) the cost of research and development for new medications, (b) the cost of promoting and advertising new medications, and (c) the proportion of (a) and (b) in comparison to their overall expenditures, and (d) the basic principles in the decision-making process involved in prescribing medications specifically using evidence-based medicine to compare outcomes and cost effectiveness of generic versus proprietary medications of the same class. (MSS Sub Res 15, I-04) (AMA Res 303, A-05 Adopted [D-295.955]) (Modified: MSS GC Report B, I-09) (D-295.955 Rescinded: CME Rep. 1, A-15) (Reaffirmed: MSS GC Report A, I-16)

#### Update on the Uses of Simulation in Medical Education D-295.330

Our AMA will:

1. continue to advocate for additional funding for research in curriculum development, pedagogy, and outcomes to further assess the effectiveness of simulation and to implement effective approaches to the use of simulation in both teaching and assessment;
2. continue to work with and review, at five-year intervals, the accreditation requirements of the Liaison Committee on Medical Education (LCME), the Accreditation Council for Graduate Medical Education (ACGME), and the Accreditation Council for Continuing Medical Education (ACCME) to assure that program requirements reflect appropriate use and assessment of simulation in education programs;
3. encourage medical education institutions that do not have accessible resources for simulation-based teaching to use the resources available at off-site simulation centers, such as online simulated assessment tools and simulated program development assistance;
4. monitor the use of simulation in high-stakes examinations administered for licensure and certification as the use of new simulation technology expands;
5. further evaluate the appropriate use of simulation in interprofessional education and clinical team building; and
6. work with the LCME, the ACGME, and other stakeholder organizations and institutions to further identify appropriate uses for simulation resources in the medical curriculum.

#### Guidelines for Mobile Medical Applications and Devices D-480.972

1. Our AMA will monitor market developments in mobile health (mHealth), including the development and uptake of mHealth apps, in order to identify developing consensus that provides opportunities for AMA involvement.
2. Our AMA will continue to engage with stakeholders to identify relevant guiding principles to promote a vibrant, useful and trustworthy mHealth market.
3. Our AMA will make an effort to educate physicians on mHealth apps that can be used to facilitate patient communication, advice, and clinical decision support, as well as resources that can assist physicians in becoming familiar with mHealth apps that are clinically useful and evidence-based.
4. Our AMA will develop and publically disseminate a list of best practices guiding the development and use of mobile medical applications.
5. Our AMA encourages further research integrating mobile devices into clinical care, particularly to address challenges of reducing work burden while maintaining clinical autonomy for residents and fellows.

6. Our AMA will collaborate with the Liaison Committee on Medical Education and Accreditation Council for Graduate Medical Education to develop germane policies, especially with consideration of potential financial burden and personal privacy of trainees, to ensure more uniform regulation for use of mobile devices in medical education and clinical training.

7. Our AMA encourages medical schools and residency programs to educate all trainees on proper hygiene and professional guidelines for using personal mobile devices in clinical environments.

#### Physician Reentry D-300.984

Our AMA: 1. Will continue to collaborate with other appropriate organizations on physician reentry issues including research on the need for and the effectiveness of reentry programs.

2. Will work collaboratively with the American Academy of Pediatrics and other interested groups to convene a conference on physician reentry which will bring together key stakeholders to address the development of reentry programs as well as the educational needs of physicians reentering clinical practice.

3. Will work with interested parties to establish a physician reentry program (PREP) information data base that is publicly accessible to physician applicants and which includes information pertaining to program characteristics.

4. Will support efforts to ensure the affordability and accessibility, and to address the unique liability issues related to PREPs.

5. Will make available to all interested parties the physician reentry program (PREP) system Guiding Principles for use as a basis for all reentry programs: a. Accessible: The PREP system is accessible by geography, time and cost. Reentry programs are available and accessible geographically across the United States and include national and regional pools of reentry positions. Reentering physicians with families or community ties are not burdened by having to relocate to attend a program. The length of time of reentry programs is standardized and is commensurate with the assessed clinical and educational needs of reentering physicians. The cost of reentry programs is not prohibitive to the physician, health care institutions or the health care system. b. Collaborative: The PREP system is designed to be collaborative to improve communication and resource sharing. Information and materials including evaluation instruments are shared across specialties, to the extent possible, to improve program and physician performance. A common nomenclature is used to maximize communication across specialties. Reentry programs share resources and create a common repository for such resources, which are easily accessible. c. Comprehensive: The PREP system is comprehensive to maximize program utility. Physician reentry programs prepare physicians to return to clinical activity in the discipline in which they have been trained or certified and in the practice settings they expect to work including community-based, public health, and hospital-based or academic practice. d. Ethical: The PREP system is based on accepted principles of medical ethics. Physician reentry programs will conform to physician licensure statutes. The standards of professionalism, as stated in the AMA Code of Medical Ethics, must be followed. e. Flexible: The PREP system is flexible in structure in order to maximize program relevancy and usefulness. Physician reentry programs can accommodate modifications to program requirements and activities in ways that are optimal to the needs of reentering physicians. f. Modular: Physician reentry programs are modularized, individualized and competency-based. They are tailored to the learning needs of reentering physicians, which prevents the need for large, expensive, and standardized programs. Physicians should only be required to take those modules that allow them to meet an identified educational need. g. Innovative: Innovation is built into a PREP system allowing programs to offer state of the art learning and meet the diverse and changing needs of reentry physicians. Physician reentry programs develop and utilize learning tools including experimenting with innovative and novel curricular methodologies such as distance learning technologies and simulation. h. Accountable: The PREP system has mechanisms for assessment and is open to evaluation. Physician reentry programs have an evaluation component that is comparable among all specialties. Program assessments use objective measures to evaluate physician's competence at time of entry, during the program and at time of completion. Program outcomes are measured. Reliability and validity of the measures are established. Standardization of measures exist across programs to assess whether or not national standards are being met. i. Stable: A funding scheme is in place to ensure the PREP system is financially stable over the long-term. Adequate funding allows physician reentry programs to operate at sufficient and appropriate capacity. j. Responsive: The PREP system makes refinements, updates and other changes when necessary. Physician reentry programs are equipped to address systemic changes such as changes in regulations. Additionally, the PREP system is prepared to respond efficiently to urgent health care needs within society including mobilizing clinically inactive physicians temporarily into the workforce to attend to an acute public health crisis, such as a terrorist, biological, chemical, or natural disaster.

6. Our AMA encourages each state which does not grant a full and unrestricted license to physicians undergoing reentry to develop a non-disciplinary category of licensure for physicians during their reentry process.

#### Nanotechnology, Safety and Regulation H-480.949

Our AMA: (1) recognizes the benefits and potential risks of nanotechnology; (2) supports responsible regulation of nanomaterial products and applications to protect the public's health and the environment; and (3) encourages continued study on the health and environmental effects of exposure to nanomaterials.

#### The Precision Medicine Initiative D-460.968

1. Our AMA will work with the Precision Medicine Initiative (PMI) to gather input from physicians to assist in the planning stages of the initiative and to improve awareness and willingness to recruit patients as participants.

2. Our AMA encourages the PMI to develop resources that will assist physicians in understanding the goals of the PMI, how to recruit and enroll patients, and how to best use the research results generated by it.

3. Our AMA continues to advocate for improvements to electronic health record systems that will enable interoperability and access while not creating additional burdens and usability challenges for physicians.

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<sup>[1]</sup> NEW TO A-18: Please Utilize Footnotes for all references.

<sup>[2]</sup> All footnotes should be Arial, Size 8

<sup>[3]</sup>Footnotes citing References should use the AMA style Manual. Example See Footnote 4

<sup>[4]</sup> Mata, D. *et al.* Prevalence of Depression and Depressive Symptoms Among Resident Physicians: A Systematic Review and Meta-analysis. *JAMA*. 2015;314(22):2373-2383.