area9 LYCEUM

Pursuing the Goals of Value-Based Health Care

With Adaptive Lifelong Learning for Health Care Professionals

- ADAPTIVE LEARNING IN FOUR DIMENSIONS

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Area9 Mission in Health Care:

"TO HELP DELIVER THE WORLD'S BEST EDUCATIONAL OUTCOMES FOR MEDICAL PROFESSIONALS IN SUPPORT OF ACHIEVING BETTER HEALTH CARE OUTCOMES, VALIDATED BY A LONG-TERM, SCIENTIFIC APPROACH."

Introduction

Global health care is in a period of transformation to an increasingly outcomes-based approach that seeks to measure the value of health care delivered. Several leading voices have emerged, urging the establishment of metrics to capture the patient health outcomes achieved per dollars spent; among them are Professor Michael Porter of Harvard Business School and Donald Berwick, MD, president emeritus and senior fellow of the Institute for Healthcare Improvement. Their research has contributed to a value-based health care (VBHC) delivery framework to restructure health care systems worldwide *(Berwick & Nolan, 2008; Institute for Strategy & Competitiveness, 2018; Porter & Teisberg, 2006)*.

Now, the next step in implementing and executing a VBHC approach is to improve the education of policymakers, managers, medical professionals, and patients. A vital component, and a key focus of this paper, is improving the training and education of physicians, nurses, and other health care professionals *(Maurer & Ryan, 2016; Moriates et al, 2014; Johansson et al, 2016)*. An effective way to equip them with the latest evidence-based practices is with an adaptive learning approach.

As this paper will address, adaptive learning is particularly well-suited to identifying and closing knowledge gaps that are common among even well-trained practicing physicians, so that these medical professionals are better able to contribute directly to improved patient outcomes and reduced health care costs.

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At Area9, we are dedicated to the mission of delivering cutting-edge adaptive learning from medical school training to continuing education for practicing physicians. Over the past two decades, we have developed and refined computer-based adaptive learning models, using a biological approach that combines the latest in brain science with cutting-edge computer technology. Instead of assuming or predicting where learners will struggle or where they will need reinforcement, which is the approach of the more traditional "inference models," biological platforms mirror how learning actually occurs. The biological approach has proven to be highly effective in training health care students and in preparing them for board certification (Healy et al, 2018), as well as in delivering meaningful continuing education and maintenance of certification (MOC) education for practicing physicians, nurses, and other clinicians.

In this paper, we will discuss the importance of continued education to equip medical professionals with knowledge and skills to improve patient health across the breadth of populations and a spectrum of diseases *(Stevenson & Moore, 2018)*. We believe the objectives of continued education and MOC are best served with adaptive learning to identify and close knowledge gaps and improve professional practice. This approach also supports lifelong learning with greater emphasis on outcomes and data collection, which is superior to merely documenting attendance *(Moore, Green & Gallis, 2009)*. As the medical community seeks to improve the preparation, training, and maintenance of medical professionals *(AMA, 2017)*, Area9 remains committed to creating content and advanced adaptive learning platforms, while also becoming a leading voice in furthering VBHC discussion.

Value-Based Health Care: Pursuing Superior Outcomes

Before further discussing how the latest advances in adaptive learning can improve the efficiency and effectiveness of medical education and continuing education, it's insightful to examine how stakeholders across the medical industry are coming together to support and expand VBHC. The International Consortium for Health Outcomes Measurement (ICHOM), for example, advocates restructuring care delivery around outcomes. To promote superior outcomes, ICHOM supports the use of health outcomes data to improve competition and results achieved, while addressing quality and inefficiencies *(Porter & Teisberg, 2006)*.

The nature of the health care environment itself poses a challenge. Rapid advances in biomedical science have not only significantly expanded understanding of health and disease and the development of new tools, but have also resulted in specialization, fragmentation, and complexity. While integrated care is viewed as an important strategy for reforming health systems, the complexity and multiple unknowns within health care can undermine successful application and evaluation of integrated care *(Kodner, 2009; Valentijn et al, 2013)*.

As the Value-Based Health Care concept is adopted, more models and solutions are emerging. Medtronic, the world's largest medical device manufacturer, for example, has devised what it calls risk-sharing models in which the company and its customers are accountable for system costs and patient outcomes. Medtronic is increasingly entering into supply agreements with customers with pricing adjusted based on how well its products work in patients, rather than affixing a per-unit cost regardless of the device's performance in individual patients *(Loftus, 2018)*. Similarly, Novartis CEO Vasant Narasimhan has called for development of drugs that are targeted to patients who stand to realize optimal benefits, which could improve public health outcomes and potentially reduce overall costs of care *(Narasimhan, 2018)*. As these examples show, VBHC is so important, it is becoming an integral part of health care delivery business models.

Education as a Pillar in Building Better Outcomes Models

Medical education is an important pillar in building better outcomes models to create and capture more value in the health care system. While the importance of quality medical education has always been recognized, the content of that education and the need to keep it fresh and relevant have not been sufficiently addressed.

One aspect of the ongoing transformation is that health care is an evolving marketplace in which new competencies are demanded, including business acumen, data analytic skills, and broader interpersonal relationship skills such as better communication and leadership capabilities *(Greenspun et al, 2016, p.1)*. In addition, multiple chronic conditions and other comorbidities, as well as behavioral health issues such as depression, demand a broader skill set *(Plogh, 2013)*. Physicians must be equipped with the appropriate skills and knowledge to diagnose and treat multiple conditions; this speaks not only to being better trained, but also to continuously upgrading their knowledge and skills through lifelong learning.

An example of expanding health care education and skill development is the American Medical Association's (AMA) "Accelerating Change in Medical Education" program launched in 2013 with grants made to 11 medical schools across the U.S. and a consortium to facilitate sharing and dissemination of new and impactful ideas and projects. Now the AMA consortium is expanding to include graduate and continuing medical education programs to promote lifelong physician learning, with discussions involving a variety of high-profile national stakeholders in medical education *(AMA, 2017)*.

Another major initiative to support medical education began in February 2013, when NEJM Group (a division of The Massachusetts Medical Society, publisher of the New England Journal of Medicine) and Area9 partnered to launch NEJM Knowledge+, which has been recognized as a highly efficient, effective way for clinicians to prepare for board exams, earn CME and MOC, and engage in lifelong learning. NEJM Knowledge+ is a first-of-its-kind platform with the most extensive smart technology that adapts to clinicians' learning goals, pace of learning, and knowledge gaps to deliver the information they need to know. In a recent survey study by Healy et al (2018), the majority of respondents rated this adaptive learning platform as helpful and the content as good for exam preparation and relevant to their learning needs. The study also found that, among NEJM Knowledge+ users in the 2014-2016 time period, a significantly higher proportion reported passing the American Board of Internal Medicine Certifying Examination (ABIM-CE) on their first attempt than the national average (95% versus 89%, z=2.6397, p=0.0083) *(Healy et al, 2018)*.

Four Factors Undermining Adoption of Value-Based Health Care

Four factors are undermining the ability of hospitals, health systems, and individual practitioners from taking a value-based approach. These same factors make it more important than ever to bring efficiency and efficacy to the lifelong learning journey of physicians as medical students, residents, and specialists:

- A shortage of doctors and nurses: A need for more doctors and nurses in the United States is a continuing trend that poses a real risk to patient care in the future. An estimated shortage of between 40,800 and 104,900 doctors is projected by 2030 *(AAMC, 2017)* and around one million nursing positions will need to be filled by 2024, highlighting the need for more personnel *(Mincer, October 2017)*. Similarly, Germany is facing a shortage of doctors, which has led hospitals to recruit more physicians from abroad. This calls for more support within the German health care system to ensure quality of care, physician wellbeing, and retention of health care personnel *(Klingler and Marckmann, 2016; Berger, 2018; Jacobs et al, 2018)*.

- Discrepancies between medical specialists and the needs of the health care field: More specialists are needed in areas of greatest demand *(Plochg, 2013; Plocgh, Klazinga & Starfield, 2009)*; examples include the lack of renal health care and cardiology professionals *(Kaduszkiewicz, 2018)*.

- Quality problems in health care delivery: The need to improve quality in health care delivery has been a focus for more than a decade *(Berwick & Hackbarth, 2012)*, with some headway, but continued challenges.

- Need for greater teamwork and cooperation among doctors, nurses and other health care providers: Health care delivery is vastly improved through teamwork and cooperation among all medical staff to address existing comorbidities and the complexity of specialized care. Delivering quality patient care requires parallel health care professional development and greater ability to address patients' need by assembling a team of health care professionals *(Valentijn et al, 2013; Baker et al, 2007; and Barach P, Cossman, 2017)*.

Medical Errors: Learning Gaps a Culprit

Another major concern within the medical community is medical errors. In the U.S., medical errors are the third-leading cause of death *(Makary et al, 2016)*. In an open letter to the Centers for Disease Control, Makary et al define the causes of death due to medical error as: errors in judgment, skills, or coordination of care; diagnostic errors; system defects resulting in death or failure to rescue the patient; and preventable adverse events (May 2016).

In November 1999, "To Err Is Human," the groundbreaking report on medical errors, was released with a shocking admission: "Health care in the United States is not as safe as it should be—and can be. At least 44,000 people, and perhaps as many as 98,000 people, die in hospitals each year as a result of medical errors that could have been prevented, according to estimates from two major studies. Even using the lower estimate, preventable medical errors in hospitals exceed attributable deaths to such feared threats as motor-vehicle wrecks, breast cancer, and AIDS" *(Institute of Medicine, 1999, p.1)*. Medical errors result in costs (including additional care necessitated by the errors) that have been estimated at between $17 billion and $29 billion per year.

At the time "To Err Is Human" was released, the founders behind Area9 were in the early stages of what has become two decades of work in adaptive learning. As we launched into our medical education work, this report demonstrated to us the importance of using medical simulators for training doctors to improve patient safety. (At the time, there were about 100 simulation centers; today, there are tens of thousands.) The American Academy of Medical Colleges (AAMC) has called the use of simulators—which replicate health issues and patient experience using lifelike mannequins, physical models, standardized patients, or computers—"the most prominent innovation in medication education" in recent years *(2011, p. 4)*. As we have seen, simulators, combined with other medical education models, can be used to identify and address knowledge and practice gaps that can exist even among skilled physicians. For example, when medical situations were recreated using simulators, doctors were shocked to discover that, when under pressure in critical situations, they often lacked the knowledge of what to do. These findings are not meant to criticize clinicians who had practiced competently for years; rather, the results shed light on how most medical education occurs. It starts with the time-starved medical student who is forced to cram for exams and, as a consequence, does not retain knowledge that's infrequently used.

Moreover, as the AMA observed in its 2017 report, "Creating a Community of Innovation," the prior focus of medical education has been to "create fully loaded, pluripotent, naïve physicians"; now, the focus is on "creating physicians who are self-directed, critically thinking, expert workplace learners…[who] learn how to know what they don't know and appropriately use just-in-time knowledge resources and decision support systems to address identified gaps" *(AMA, 2017, p. 20)*. This shift can be accomplished through best practices in adaptive learning to deliver CME and MOC, by identifying learning gaps and making learners more aware of what they don't know and/or are less sure of. One way this is accomplished is by asking learners to self-assess how sure they are of an answer, which continually develops self-assessment skills. To improve attitudes toward medical errors and adverse events, research also supports the need for implementing a patient safety curriculum that promotes learning regarding adverse events *(Vohra et al, 2007)*.

At Area9, we see there is both great opportunity and a strong imperative to intervene in the medical community's life cycle of learning to promote more value in the system by furthering knowledge, encouraging greater collaboration among professionals, and improving interaction between physicians and patients. By addressing knowledge gaps, our hope is that the incidence of medical errors can be reduced significantly.

Four–Dimensional Learning in Health Care

While knowledge is a major component of learning, it is not the only aspect. Charles Fadel, founder of the Center for Curriculum Redesign, has described education and learning in terms of four dimensions: knowledge, skills, character, and meta-learning (i.e., learning how to learn) *(CCR, 2018)*. The challenge of traditional education is how to impart baseline knowledge to students so that they can keep learning and apply new knowledge as they interact with others. Corporate learning and development professionals face the same dilemma of how best to educate workers in specific areas. The elusive goal has been establishing a streamlined process for learning in order to achieve automaticity—that is, acquisition of knowledge and skills to the point they become "second nature." In promoting VBHC and improved patient outcomes, a certain degree of automaticity must be achieved among physicians, nurses, and other clinicians, including to know instinctively how to intervene when patients are in crisis or medical trauma.

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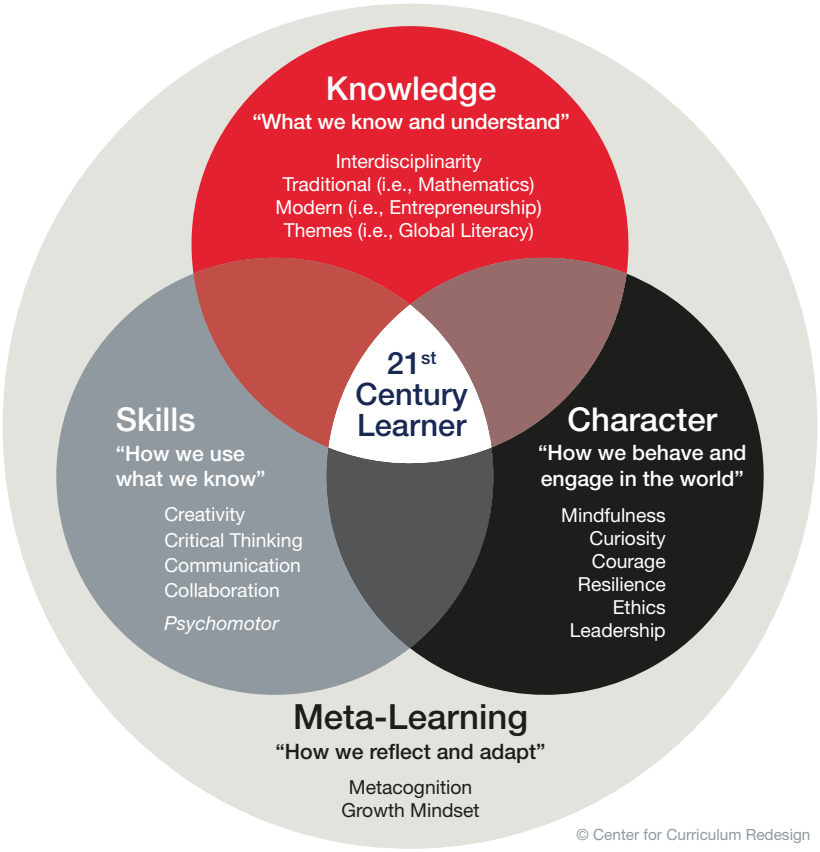

The solution to greater knowledge acquisition, uncovering knowledge gaps, and promote lifelong learning is adaptive learning. Area9's adaptive learning model in medical education uses Bloom's taxonomy to map very detailed learning objectives of the curriculum. This is congruent with the approach advocated by the AMA in its medical education initiative, which also involves developing a formalized method of analyzing medical school exam questions using Bloom's taxonomy *(AMA, 2017)*.

One area in medical education we believe holds great promise is expansion of simulation training. Area9 founders started their medical education careers in medical simulation in the 1990s and pioneered the development of computer-based medical simulators as well as hybrid models with physical simulators for team-training and skills development.

Currently, medical students and residents can access simulators in hospitals or other health care centers. Moving forward, we see the opportunity to more closely and robustly integrate adaptive learning with simulators to achieve a multifaceted learning experience. The adaptive learning platform would identify knowledge and skill gaps among medical students and practicing physicians, who can then further develop their skills and expertise via simulators in physical locations, as well as by using computer-based simulations that can be conducted anytime, anywhere.

Conclusion: In Pursuit of Lifelong Learning

It's not a simple undertaking to educate and train health care providers who deliver reliable patient safety and quality outcomes. But the goals are clear, as stated in Batalden-Davidoff's definition of quality improvement in health care: patient outcomes, system performance, and professional development *(Batalden, 2007)*. With these goals in mind, the role of continuous, lifelong learning is clear. No matter how well-trained or experienced, physicians and other health care professionals must upgrade their knowledge and skill set to remain relevant and competent to address the complexities of modern health care.

References:

American Medical Association. *Creating a Community of Innovation.* 2017. AMA

Association of American Medical Colleges. *Medical simulation in medical education: results of an AAMC survey*. September 2011. AAMC.org

Association of American Medical Colleges. *New research reaffirms physician shortage*. 2017. AAMC.org

Baker, D.P., Salas, E., King, H., Battles, J., & Barach, P. *The role of teamwork in the professional education of physicians: current status and assessment recommendations.* The Joint Commission Journal on Quality and Patient Safety. 2005;31(4):185-202. Joint Commission Journal

Batalden, P.B. and Davidoff, F. *What is "quality improvement" and how can it transform healthcare?* Quality & Safety in Health Care. 2007;16(1);2-3. NCBI

Barach, P., and Cosman, P. *Teams, team training, and the role of simulation. Pediatric and Congenital Cardiac Care: Vol 2:* Quality Improvement and Patient Safety. 2015. Academia.edu

Berger, R., *Krankenhausstudie, 2017*: München

Berwick, D. & Hackbarth, A. *Eliminating waste in U.S. health care.* JAMA. 2012;307(14):1513-1516. JAMA Network

Berwick, D., Nolan, T. & Whittington, J. The triple aim: care, health, and cost. Health Affairs. 2008;27(3) HealthAffairs

Center for Curriculum Redesign. Four-Dimensional Education. 2018. curriculumredesign.org

Greenspun, H., Abrams, K., and Kane, A. *Preparing the Doctor of the Future, Deloitte Center for Health Solutions*. 2016. Deloitte University Press

Healy, M., Petrusa, E., Axelsson, C.G., Wongsirimeteekul, P., Hamnvik, O., O'Rourke, M., Feinstein, R., Steeves, R., and Phitayakorn, R. An Exploratory Study of a Novel Adaptive e-Learning Board Review Product Helping Candidates Prepare for Certification Examinations. August, 2018. AMEE MedEdPublish

Institute of Medicine. *To err is human: building a safer health system*. November, 1999. NationalAcademies.org

Institute for Strategy & Competitiveness. *Value-based health care delivery.* 2018. HBS.edu

Jacobs, K., Kuhlmey, A., Greß, S. & Klauber, J. Schwinger, Antje 2018: *Pflege-Report 2018 – Qualität in der Pflege*, Berlin: Springer-Open

Johansson, B., Fogelberg-Dahm, M. & Wadensten, B. *Evidence-based practice: the importance of education and leadership*. Journal of Nursing Management. 2010;18(1):70-7. NCBI

Kaduszkiewicz, U., Teichert, H., & van den Bussch, H. *Ärztemangel in der hausärztlichen Versorgung auf dem Lande und im Öffentlichen Gesundheitsdienst, Bundesgesundheitsblatt - Gesundheitsforschung – Gesundheitsschutz*, February 2018;61(2):187–194.

Klingler, C. & Marckmann, G. *Difficulties experienced by migrant physicians working in German hospitals: a qualitative interview study*. Human Resources for Health. 2016;14:57. NCBI

Kodner, D.L. *All together now: a conceptual exploration of integrated care.* Healthcare Quarterly. 2009;13(Sp):6-15. NCBI

Lofus, P. *Medtronic moves to a new health-care model: pay only if it works.* The Wall Street Journal , Feb. 19, 2018.

Makary, M. et al. *Open letter to Centers of Disease Control*. May 2016. LINK

Maurer, K & Ryan, A. *No hospital left behind? Education policy lessons for value-based payment in healthcare*. 2016; 11(1):62-4. NCBI

Mincer, J. Short on staff: *Nursing crisis strains U.S. hospitals.* Reuters ; Oct. 20, 2017.

Moriates, C., Mourad, M., Novelero, M & Wachter, RM. *Development of a hospital-based program focused on improving healthcare value*. Journal of Hospital Medicine. 2014;9(10):671-7.NCBI

Moore D., Green J., Gallis, H. *Achieving desired results and improved outcomes: integrating planning and assessment throughout learning activities.* 2009;29(1):1-15. Wiley Online Library

Narasimhan, V. Novartis CEO: *We need a different approach to drug discovery.* Fortune, March 12, 2018.

Plochg, T. *Reconfiguring health professionalism towards addressing multimorbidity.* Eurohealth. 2013;19(2):24-27. EuroHealth

Plochg, T., Klazinga, N, & Starfield, B. *Transforming medical professionalism to fit changing health needs.* BMC Medicine. 2009;7(1):64. BMC Medicine

Porter, M. & Teisberg, E.O. Redefining Health Care: *Creating Value-Based Competition on Results*. Boston: Harvard Business School Press, 2006

Stevenson, R. and Moore, D. *"Ascent to the Summit of the CME Pyramid." JAMA*. 2018;319(6):543-544. JAMA Network

Valentijn, P.P., Schepman, SM, Opheij, W. & Bruijnzeels, MA. Understanding integrated care: a comprehensive conceptual framework based on the integrative functions of primary care. *International Journal of Integrated Care.* 2013 Jan-March; 13:e010. NCBI

Vohra, P., Johnson, J., Daughtery, C., Wen, M., and Barach, P. Housestaff and medical student attitudes toward medical errors and adverse events. *The Joint Commission Journal on Quality and Patient Safety. 2007;33(8).* NCBI