Coordinated Learning to Improve Evidence-based Care: A Model for Continuing Education for the New Healthcare Environment

John E. Ruggiero, PhD, MPA, CHCP; Caroline O. Robinson, PhD; Nancy Lutz Paynter, MBA, CHCP

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EXECUTIVE SUMMARY

The success of healthcare reform to meet the goals of the *Triple Aim*—better care. better health, and lower cost for all-relies in large part on the capacity for learning and behavior changes at both individual and collective levels. We must ensure that patients are enabled to replace unhealthy practices for behaviors known to promote and maintain good health. as well as behaviors that will enable them to effectively communicate with healthcare professionals about their care. We must also ensure that healthcare professionals are enabled to adopt evidence-based clinical behaviors and practices with potential to improve

patient outcomes, even as the volume of biomedical and clinical information that clinicians must now consider for a given patient exceeds their cognitive capacity to digest and apply. Critically, this cognitive overload can delay the integration of new evidence and clinical data to everyday practice. Finally, we must ensure that healthcare systems are enabled to embrace new organizational and care delivery strategies—such as team-based care and clinical decision support—to improve care coordination.

Yet current models of continuing education for health professionals largely position learning, performance improvement, and behavior change as an individual endeavor. Such models reinforce individualized decision-making and other clinical behaviors which may increasingly serve as an insufficient foundation for learning and behavioral change within the current day healthcare environment, wherein decisions are seldom made and implemented without involving the work and actions of others.

Affiliation: Genentech, Inc.

CORRESPONDENCE:

For CGN information, comments related to this paper, or for interest in using this model, please contact Dr. Caroline O. Robinson (<u>robinson.caroline@gene.com</u>) and/or Dr. John Ruggiero (<u>ruggiero.john@gene.com</u>).



In order to educate healthcare professionals to contribute to the societal goals of the Triple Aim and deliver patient-centered care in a context of accelerated knowledge growth, continuing education design, implementation, and evaluation should address not only learning impact and behavior change at the level of the individual, but also at the level of teams, organizations, and systems. Accordingly, we propose a new learning engagement model to support a quality-focused approach to continuing education that can help to narrow the gap between knowledge generation and knowledge translation, and achieve care coordination.

INTRODUCTION: 'MORE TO DO, MORE TO KNOW, MORE TO MANAGE'

The organization, delivery, and reimbursement of healthcare in the United States (US) has been undergoing a seismic process of transformation that has profound implications for the role of continuing education (CE) among healthcare professionals.

Quality of Care Prioritized

The six priorities of the National Quality Strategy (Table 1) provide a framework for pursuing the goals of the **Triple Aim** better care, better health, and lower cost for all—and reinforce the importance of the effective and timely translation of biomedical research and clinical data into clinical practice, as well as the integration of best practices to organizational, reimbursement, workforce, and information systems.^{1,2}

Notably, these priorities expand the role of patients and their families and

Table 1. National Quality Strategies Priorities

Making care safer by reducing harm caused in the delivery of care	Ensuring that each person and family is engaged as partners in their care
Promoting effective communication and coordination of care	Promoting the most effective prevention and treatment practices for the leading causes of mortality, starting with cardiovascular disease
Working with communities to promote wide use of best practices to enable healthy living	Making quality care more affordable for individuals, families, employers, and governments by developing and spreading new health care delivery models

caregivers as an important ingredient for high quality healthcare.³ Healthcare providers (HCPs) will increasingly be expected to **engage patients** in making decisions about their health and healthcare, and to support patients to make behavioral changes through the addition of intensive patient education to routine medical management. Such engagement will require an expanded knowledge base for HCPs, for patients, and for their families and caregivers.⁴

Healthcare Delivery, Re-Engineered

In an effort to curb costs, reimbursement redesign is shifting care delivery from a fee-for-service to a fee-for-value model via performance metric-based programs such as Medical Advantage, Meaningful Use, and the Patient Quality Reporting System.⁷ Patient care is also transitioning from a physician-centric, hospital-based system to one that encourages new resource- and cost-sharing models to

Emerging Care Coordination Measures

Care coordination across providers and settings represents a critical pathway to achieving the goals of the Triple Aim. The Institute of Medicine (IOM) estimates that care coordination initiatives (e.g. American College of Physicians' High Value Care <u>Coordination</u>), could contribute savings of up to \$240 billion by reducing avoidable readmissions, unplanned emergency room visits, medication errors and the suffering these errors engender.⁵ Accordingly, the Agency for Healthcare Research and Quality (AHRQ) is currently developing *Framework* to help assess the experience and effects associated with care pathways, and the National Quality Foundation (NQF) is reviewing care coordination performance measures focused on patient experience of care, health information technology (IT), transitions of care, and structural measures.⁶

ensure organizational efficiencies (e.g. accountable care organizations [ACOs]).8 At the same time, the increasing prevalence and complexity of chronic disease involves prolonged management with multiple primary and specialist providers, as well as across hospital and community settings. In order to deliver appropriate, patientcentered care where it is most needed, new delivery models, such as the patient-centered medical home, emphasize care coordination for defined populations through a focus on education, prevention and wellness,⁹ and acknowledge a **team-based** approach to coordinating care as the best model for addressing complex health needs and reducing costs.^{10,11} These changes will require education strategies that support the teambased delivery of healthcare.

Cognitive Overload—Delaying the Transfer of Knowledge to Practice

Adding to the complexity of healthcare delivery in this reform era, therapeutic

innovations have accelerated, diagnostic and care management options have multiplied, and biomedical knowledge continues to accumulate at an unprecedented rate. Attempts to quantify this knowledge acceleration estimate that approximately 27.000 articles are published each week in peer-reviewed biomedical and clinical journals, and within 3-4 years of initial board certification, both generalist and subspecialist internists show substantive declines in medical knowledge.^{12,13} The volume of biomedical and clinical information that clinicians must now consider for a given patient exceeds their cognitive capacity to digest and manage,¹³ and delays the application of new evidence and clinical data to patient care. Indeed, research suggests that, on average, it can take 17 years for scientific and clinical evidence to be adopted within clinical practice.^{1,14}

These barriers limit the potential for HCPs to reach consistently evidence-aligned clinical conclusions and offer patients accurate information about likely outcomes, and are manifest in the variable uptake of care innovations. Notably, a serious gap persists between 'what we know works'-based on scientific evidence—and the care that is actually delivered to patients. A seminal RAND study on practice patterns reported that up to 45% of patients do not receive recommended care,¹⁵ and many studies affirm the persistence of too many unplanned readmissions, medication errors, and hospitalacquired infections, as well as suboptimal delivery of primary and secondary prevention of the major diseases that account for chronic conditions.^{12,16} HPCs will increasingly need education support to ease the burden of cognitive overload and reduce this learning and application curve.

An Expanded Knowledge Base for Coordinated Care Delivery

These changes and factors suggest that the success of healthcare reform relies in large part on the capacity for **learning and behavioral change** at both individual and collective levels, as well as across patients and caregivers, HCPs, and health care as a system.¹⁷ Notably, evidence from several domains suggests that education that includes patient-centered approaches and perspectives; addresses health professionals as teams; and leverages the power of information technology to generate and deliver real-time data can improve learning, clinical outcomes, and care coordination (Table 2).

CONTINUING EDUCATION AS AN AGENT OF CHANGE

From Cognition to Collectivity

Continuing education (CE) is uniquely positioned to help clinicians and patients adopt evidence-based behavior changes through a process of continuous learning aligned with the Triple Aim.³² Yet, traditional models of professional education view learning and behavior change as an **individual**, cognitive endeavor. These models are based on a philosophy of learning that emphasizes the importance of the uniquely human capacity to reason, on which individuals draw to gain insights about problems, and weigh the benefits and costs of action among a range of options (such as that espoused by Jean-Jacques Rousseau). For instance, current educational theories emphasize the importance of intention in prospective and development behavior change (e.g. Theory of Planned

Behavior),³³ while Stages of Change theory emphasizes how individual learners move from pre-contemplation, to contemplation, to preparation, to action to maintenance.³⁴ These perspectives view the acquisition and application of knowledge in decision-making as an individual exercise, regardless of the incentives, motivations, or triggers to act. This focus on the individual also underpins current outcomes evaluation frameworks (e.g. Moore *et al* 2009),³⁵ which primarily assess how education activities close clinical and performance gaps for individual clinicians in a stepwise, unidirectional fashion across distinct levels of outcome. However, this approach runs the risk of reinforcing individualized decision-making and other clinical behaviors,³⁶ and in so doing, fails to provide a sufficient foundation for changing both provider and patient behaviors, since changes are seldom made without involving interactions with others.^{13,25}

Foundations and Frameworks to Collapse the Learning Curve

More socially inflected philosophies of learning emphasize that because education is a prerequisite for a well-functioning social and political order, individuals typically take action to learn in a purposeful effort to change their environment ³⁷ to respond to changes or disruptions in their environment,³⁸ or, indeed, to challenge the status quo. In doing so, learners actively evaluate the problems that face them, acquire the skills and knowledge they need to address the problems, seek resources to assist their learning, and solicit information about the experiences of others in using new information or skills.³⁹

Educational strategies to change clinical behaviors in ways that improve care are also considered more powerful when they attend

Table 2. Education Strategies for Improving Clinical Outcomes and Care Coordination

Engaging Patients—Improving Clinical Decisions and Outcomes

Patients need to replace unhealthy practices with behaviors known to promote and maintain good health, and adopt behaviors that will enable them to effectively communicate with healthcare professionals about their care. Studies across different disease states (e.g. diabetes, migraine, chronic heart failure) suggest that when patients are armed with robust, evidence-based information and peer support, they are better prepared to make behavioral changes that lead to improved clinical outcomes (e.g. better glycemic control) and that reduce utilization of healthcare resources.^{18,19} Moreover, patients with many different types of health conditions that are engaged in their care report better healthcare experiences (e.g. fewer care coordination problems, lower hospitalization or 30-day hospital readmission rates, and have fewer diagnostics tests or referrals).¹⁹ They are also much more likely to prepare questions to ask a provider prior to a clinical encounter,²⁰ feel better equipped to make decisions about their care,²¹ and have lower billed healthcare costs.²²

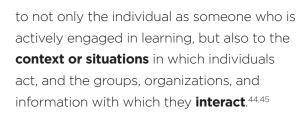
Educating the Healthcare Team—Improving Care Coordination

HCPs need to more quickly adopt evidence-based clinical behaviors and practices with potential to improve patient outcomes. Additionally, in order to narrow the gap between knowledge generation and knowledge translation, and deliver coordinated care, providers from all disciplines must be able to work together in collaborative, interdependent teams, as well as in partnership with patients, their families, and their caregivers.^{23,24} In acknowledgement of accumulating research, the IOM and other professional organizations have endorsed the view that education for the whole healthcare team that focuses on evidence-based practice, quality improvement (QI), and using informatics in patient care, leads to better coordinated care and outcomes, improved care processes and patient satisfaction, and reduced costs.^{9,23,25,26}

Resourcing the Healthcare System—Enhancing Decision-Making

Healthcare systems need to embrace organizational strategies and models that engage both HCPs and patients in the service of better coordinated care through the prism of quality improvement (QI). For example, the currently expanding health information technology infrastructure offers potential for clinicians to capture real-time data to generate insights about the patient's experience of care, while using point-of-care data can support clinical decision-making and improve clinical outcomes.²⁷ Patient access to their personal health records is expanding through the development and adoption of a wide variety of patientfocused self-management tools, policy shifts that have provided health information technology incentives (notably, the Centers for Medicare and Medicaid's Meaningful Use program), and national-level resources such as the National eHealth Collaborative Patient Engagement Framework.²⁸, Alongside patients' unprecedented access to their own medical records, explosive growth in digital tools and resources now also available to patients is enabling patients to have access to evidence-based information to support decision-making, and opportunities to capture, monitor, and share biometric and other forms of healthrelated data with their healthcare providers and with other patients.²⁹ In an environment characterized by highly-dynamic, complex information production and exchange, HCPs and patients who can see and share their own real-time clinical data and point-of-need information are better prepared to effectively navigate health decisions and more likely to adopt evidence-aligned behaviors.^{30,31}

The use of QI principles in healthcare is critical to—and can—address variations in care. Notably, as described here, purposeful review of systems-based data can reduce process barriers to, and support more rapid integration of evidence-aligned clinical care. QI initiatives typically require supportive education. To this end, as previewed by the Alliance for Continuing Education in the Health Professions (ACEhp) in its Quality Improvement Education (QIE) Roadmap, CE is poised to act as an indispensable agent of QI change.³²



The delivery of health care occurs in a complex context characterized by several interdependencies, including different spaces and places of focus (e.g. ambulatory care centers, physician offices, inpatient hospital units); the policy, payment, and regulation environment; the patterns of communication that reinforce social and professional norms.⁴⁶⁻⁴⁸ These interdependencies interact with one another to influence behavior alongside situational or contextual cues. Such cues include environmental text and imagery, professional relationships, hierarchical pressures, organizational workflows, technology, and background information such as gender, age, and other social characteristics that inform decision-making, clinical reasoning, and care delivery.⁴⁹⁻⁴⁵ In every day practice, clinicians may or may not be aware of these cues, yet they can hinder or engineer desired clinical and patient behaviors by reconfiguring the clinical 'choice architecture' to encourage individuals to adopt behaviors that promote better outcomes.^{50,51} For instance, digital health tools are emerging that use real-time biometric other forms of health-related data to 'nudge' patients to make behavioral adjustments (e.g. take their medications as prescribed).⁵² Additionally, clinical decision support (CDS) tools such as order sets, patient data reports, dashboards or rules, reminders, and alerts (e.g. about deviating lab results, drug-drug interactions, or drug dosage errors) present the best available clinical knowledge in 'intelligently filtered', easily accessible, standardized formats available

EXAMPLES OF SITUATIONAL CUES

Disruptive Situational Cues

Professional Power Professional hierarchies and status differences in complex healthcare systems can hinder the delivery of evidencealigned care. At times, clinicians may fail to understand each other's professional roles, perceive role (or territory) overlap, or lack a shared understanding of the care that patients need. Differences in professional power and status often pose barriers to assertive communication, for instance, making it inconceivable for junior physicians or nurses to 'speak up' and challenge senior physicians when they fail to deliver appropriate care, also lie at the heart of many sentinel events.⁴⁰

Enabling Situational Cues *Checklists*

Gawande popularized the importance of the surgical checklist as an important QI tool. Now, several national organizations support the use of checklists and other decision support tools to support evidencealigned care delivery, especially in preoperative and surgical contexts. Studies are now indicating that a structured approach to care delivery and documentation supported by a checklist improves safety, morbidity, and morality.⁴¹

Team-Based Protocols

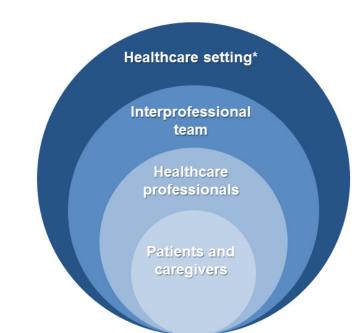
Safety and quality of care is compromised when teamwork is poorly coordinated. In fact, in 2013-2014, the Joint Commission attributed 63% of sentinel events to communication and teamwork breakdown.⁴² AHRQ has designed the TeamSTEPPS curriculum as a series of structured communication protocols that build a common language to support teambased communication. The curriculum includes tools such as debriefing, situation monitoring, SBAR (situation, background, assessment and recommendation).⁴³ Team members can also use these tools to 'speak up' if they have concerns about quality of care and to resolve professional conflicts.

at the point of care.^{31,53} This integrated, structured information can be harnessed to engineer new behaviors in ways that preserve the freedom of clinicians to make clinical judgments and the freedom for patients to make lifestyle selections from a range of alternatives.⁵⁴ Though, it must be acknowledged that the adoption and expansion of the use of electronic health records and related interfaces among healthcare systems has and continues to tax the time and attention of healthcare professionals, leading to frustration with these technologies and tools, which may thwart their overall usefulness and capacity to improve care quality.

Learning and behavior change are also **relational processes** in which clinicians and patients exchange experiences, learn from each other (e.g. in communities of practice, or face-to-face/virtual patient networks), and collectively envision how their practice or experiences could be improved.^{55,56} Learning and behavior change therefore implies a **continuous process** in which people, as group members, acquire, create, and synthesize relevant knowledge, including not only scientific knowledge, but also practical, experiential, and tacit knowledge, and test out different strategies to solve both individual and systems-based problems, adapt to environmental changes, and enact goals.⁵⁷

These insights underscore the complexity of learning. They require us to pay attention to how learning occurs in particular places within and across individuals (i.e. clinicians and patients), within and across teams, and within and across healthcare organizations. Such an understanding is aligned with what the IOM calls the **learning healthcare system** (Figure 1).

Figure 1. Members of the learning healthcare system



* Healthcare setting refers to a range of organizational structures through which healthcare is delivered, including integrated healthcare delivery networks, Accountable Care Organizations, inpatient care systems or outpatient care provider organizations.

In this system, opportunities for learning are **cued** by turning data available from routine clinical care into knowledge and converting knowledge into point-of-care guidance for clinicians and patients.²⁷

Consequently, if members of the CE community are to be effective participants in the QI endeavor as it unfolds in the learning healthcare system, we will need a more nuanced model for designing, implementing, and evaluating learning.

A NEW EDUCATION MODEL THAT ADDRESSES CARE COORDINATION VIA THE HEALTHCARE PROFESSIONAL, THE INTERPROFESSIONAL TEAM, AND PATIENT ENGAGEMENT

Translational Mechanisms for Continuous Learning

The accumulated insights from behavioral economics, cognitive psychology, and organizational sociology described above about individual and collective learning and behavior change suggest a series of translational mechanisms to inform a process of learning in complex environments such as health care (Figure 2). When applied to HCP, patient, and system information and education needs, we suggest that these mechanisms offer a foundation for continuous learning engagement with potential to collapse the learning curve and advance more rapid adoption of emerging clinical evidence.

Adoption of these insights and mechanisms necessitate a move away from traditionally modeled CE interventions to correct individual provider-based performance gaps toward a framework that supports practice- and systems-based interventions that:^{32,58}

- 1. Are integrated across the healthcare delivery sector;
- 2. Focus on both healthcare practitioners and patients;
- Measure competence and learning effect at the level of individual, team, and system;

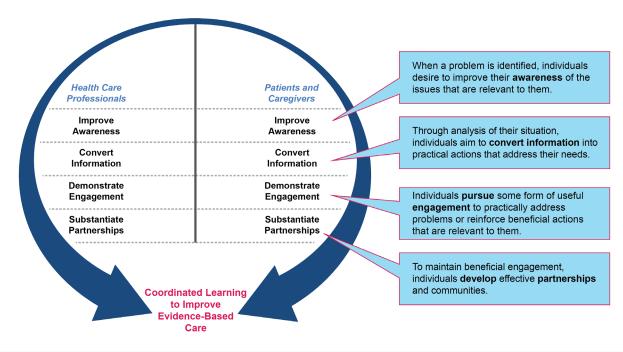


Figure 2. Translational mechanisms that inform continuous learning

- 4. Evaluate the impact of education on quality, safety, and efficiency; and
- 5. Capture not only whether education interventions improve clinical practice but also whether how and why such interventions work or fail.

We propose a continuous learning engagement model that is consistent with these mechanisms of learning and change and is aligned with the concept of a learning healthcare system (Figure 3).

The model acknowledges that while patients and clinicians make what they may view as rational choices about health and disease management (e.g. participate in risky health behaviors, order diagnostic tests, prescribe certain medications), they do so in complex healthcare environments influenced by factors and interactions often unseen—about which they may be unaware.⁵⁹ Respectively, they also deliver and receive care within complex healthcare systems that are each characterized by unique structural contexts, workplace cultures, and organizational processes. The various settings in which healthcare may be delivered, such as those referenced within Figure 1, constitute these healthcare "systems." The unique characteristics of these various systems are undoubtedly factors associated with healthcare variation, but the CE community can also creatively draw upon these unique characteristics as resources in the design of education initiatives, or "learning solutions", that transform practice and behavior in context, and, ultimately, improve quality of care for defined patient populations. By combining a systems-based approach to education with attention to behavior and learning stages, healthcare and CE stakeholders can collectively work to collapse the learning curve.

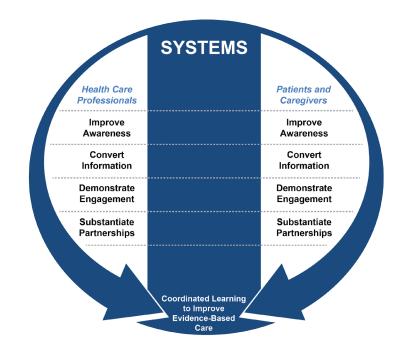


Figure 3. The context of continuous learning in healthcare systems

This system-based, behavioral stages model includes a series of steps (Figure 4), in which education interventions or learning systems can:

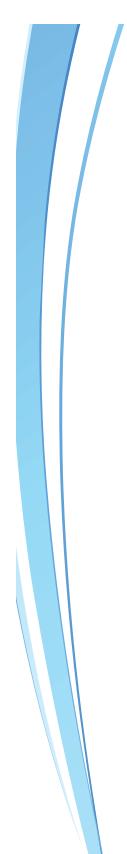
- Activate personal commitment among interprofessional HCP teams and patients/caregivers by increasing their awareness about evidence-aligned knowledge and care delivery gaps in their healthcare system and within their own healthcare practices and by helping them to become more informed about evidence-aligned care.
- 2. Advance personal commitment among interprofessional HCP teams and patients/caregivers by using health information as a way to demonstrate learning (pre- versus post-learning intervention); capturing commitments to reinforce practices and/or make improvements where necessary; and demonstrating where improvements will be implemented and whether such

improvement can be reproduced in other settings.

- 3. Identify behavior changes that help interprofessional HCP teams and patients/caregivers **aspire** to engage with one another, via education that supports communication skills for HCPs and, for patients, addresses how decisions made beyond the clinic can improve the healthcare gap (e.g., such as behaviors that yield increased patient engagement and personal sense of control).
- 4. <u>Allocate</u> goals and decisions among HCPs and patients/caregivers that place commitments into action by encouraging and supporting collaboration and partnerships between HCPs and/or patients to improve communication and share timely data; demonstrate the clinical significance of improvements over time; identify, where possible, cost savings; and use improvement data to support future initiatives.

Figure 4. Behavior and learning strategies in learning healthcare systems





Therefore, this proposed circular system learning measurement model (Figure 5), or The Expanded Learning Model for Systems (TELMS), offers a framework for designing, implementing, and evaluating learning solutions that move both HCPs and patients through a series of learning stages to enable them to adopt evidence-based behaviors informed by quality and performance indicators, and which will help CE stakeholders to demonstrate how such changes lead to improvements in care coordination and quality of care. Not all education programs will need to move all constituents through all learning stages all of the time. On one hand, in critical complex situations, learning is best viewed as a cycle that may need to be repeated over time, depending on the specific gap that is being addressed. For example, when novel therapeutic options become available, the cycle may need to

be repeated to ensure adequate adoption of evidence. On the other hand, certain gaps may only require one area of focus, such as activating HCPs and patients/ caregivers to improve their awareness of a particular deficit, for example as in a specific area of adherence improvement.

This framework offers potential to capture **levels** of outcome, as well as outcomes for a **range of constituents** (i.e. HCPs and patients) across different **settings** (e.g. as care transitions from hospital to community contexts), and uses measures that capture procedures and processes that can lead to change.^{33,60,61}

BENEFITS OF THE MODEL

Achieving Care Coordination, Elevating Continuing Education

The power of the proposed model, TELMS, to measure the effectiveness of integrating

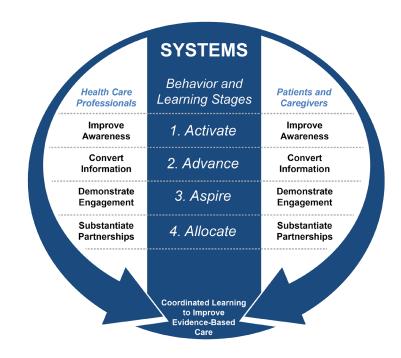
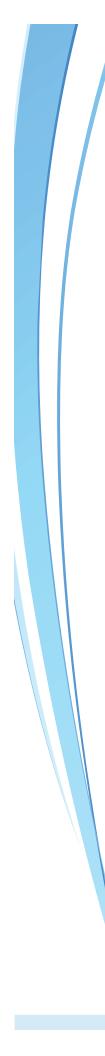


Figure 5. <u>The</u> <u>Expanded</u> <u>Learning</u> <u>Model</u> for <u>Systems</u>



learning solutions with the goals of the Triple Aim will need to be validated.

Nonetheless, we believe there are at least 3 principle benefits of this model for CE stakeholders. First, learning solutions that integrate practice- and systemsbased strategies for change alongside learning for individual behavior change, as supported by this education and learning engagement model, can potentially improve evidence adoption, collapsing the learning curve and, in so doing, improve care coordination in ways that meet the goals of the Triple Aim. Second, the model supports methodologies to evaluate complex educational interventions in complex environments (e.g. by tracking and monitoring whether and which behavior modifications are occurring across different stakeholder groups and levels), which could elevate learning solutions—and CE specifically—to a more significant presence in the workplace setting and consolidate its role as integral to change processes in healthcare.^{32,62} Third, the model provides providers and supporters of CE with a reproducible format for developing education programs and reporting their outcomes-including measures of motivation, teaching styles and learning theories-that is consistent with the Standards for Quality Improvement Reporting Excellence (SQUIRE) framework for integrating education and educational professionals into QI planning and implementation.⁶³ Furthermore, by applying such a model, CE stakeholders can collapse the learning curve, sharpen their focus on clinical outcomes, and demonstrate greater value to clinicians and patients.

NEXT STEPS

We invite you to participate in an initiative to validate TELMS, as a practical framework. As an example, Genentech recently published several Call for Grant Notifications (CGNs) with the aim of achieving, through a learning solution, what would be appropriate for a disease area that has an established body of evidence, and is, therefore, beyond "emerging information." In such a disease area, the objectives of learning initiatives may be more focused on improving the prevalence and consistency of evidence-aligned care decision-making. The educational providers utilized the latest data to educate participants in order to evaluate the management of evidence that leads to appropriate decision-making. Significantly, an underlying objective of the recent call for proposals was to provide support for learning initiatives that aimed to advance confidence and adoption of evidence across the full scope of actors within the healthcare pathway (i.e., patients, HCP teams, and healthcare system settings) and to measure the impact of the initiative effectively (and perhaps differently) among the levels of impact, such as among HCPs, interprofessional teams, patients and/or care delivery setting.

The selected educational providers designed programs to demonstrate that learners reflected upon the educational activity, improved competence as a result of it, and used evidencebased concepts to consider changing behavior where appropriate or relevant. Consideration was given to learning initiatives which were designed to further demonstrate that:

- A learning program activated the participants to improve their awareness about the current problem, purpose and culture of the gap;
- 2. A learning program **advanced** the participants to **convert the information** to demonstrate where and when improvements in care will be implemented:
- 3. Participants of educational activities aspired to demonstrate engagement within interprofessional teams (patients included if appropriate), such as by using any system-required metrics (including patient satisfaction scores if relevant) that show closure of the treatment gap and identifying how it continues to close/evolve over time; and
- 4. The learning program measures indicate the participants gained the skills or changed behaviors to be able to deliver more evidence-aligned care or to make evidence-based decisions, thus resulting in the **allocation of engagement** across

the scope of actors necessary to effect improved care delivery, such as commitments to partnership in communication and/or sharing of timely data that impact the delivery of care, adherence to jointly decided recommended care plans, and an identification of behaviors which will advance care in the future.

In addition, educational providers were encouraged to use their outcomes data to project the extent to which conversion of information is sustained over time, and whether or not these improvements can be reproduced in other environments.

In order to support continuous learning, we invite accredited providers to share with us their experiences utilizing the model in industry-supported IME initiatives. We also intend to encourage such providers to join a virtual platform to share their data. Results from these projects are anticipated to be collated and subject to a metaanalysis and shared with the wider CE community via ACEhp.

ACKNOWLEDGEMENTS

We thank **Wayne Lilyestrom** for contributing to the development of the model and **Alexandra Howson** for her significant contribution to the manuscript development. We also thank the peer reviewers of the manuscript, **Simone Karp, Michele Galioto,** and **Errol Ozdalga.**

Finally, we would like to thank the members of our working group for their contribution to the refinement of the model: **Louis Diamond, Gautam Gulati, Patty Jassak,** and **Mazi Rasulnia.**

REFERENCES

- Balas EA. Managing clinical knowledge for health care improvement. In: Bemmel J, McCray AT, editors. Yearbook of Medical Informatics 2000: Patient-Centered Systems. Stuttgart, Germany: Schattauer Verlagsgesellschaft mbH; 2000:65-70.
- Working for Quality. 2011 Report to Congress: National Strategy for Quality Improvement in Health Care. Agency for Healthcare Research and Quality;2011. <u>http://www.ahrq. gov/workingforquality/ngs/ngs2011annlrpt.htm</u>. Accessed July 7, 2015.
- Millenson ML, Macri J. Will the Affordable Care Act move patient-centeredness to center stage? Robert Wood Johnson Foundation. 2012. <u>http://www.urban.org/sites/ default/files/alfresco/publication-pdfs/412525-Summary-Will-the-Affordable-Care-Act-Move-Patient-Centerednessto-Center-Stage-.pdf. Accessed July 7, 2015.
 </u>
- McMahon GT. Advancing continuing medical education. JAMA. 2015;Jul 20. doi; 10.1001/jama.7094. [Epub ahead of print]
- Institute of Medicine. Young PL, Suanders RS, Olsen LA (eds). Roundtable on value and science-driven health care: The Healthcare Imperative: Lowering costs and improving outcomes: workshop series summary. Washington, DC. 2010. <u>http://www.hci3.org/sites/default/files/files/ IOM%20Roundtable%20Lowering%20Costs%20&%20</u> <u>Improving%20Outcomes.pdf</u>. Accessed June 22, 2015.
- National Quality Forum. NQF-endorsed measures for care coordination: Phase 3. Washington DC: National Quality Forum. 2014. <u>https://www.qualityforum.org/</u> <u>Publications/2014/12/NQFEndorsed Measures for Care</u> <u>Coordination Phase 3.aspx</u>. Accessed June 22, 2015.
- Andrews KL, Kaplan LJ, Mercado S. Quality performance measures: the tie that binds reimbursement, licensure, certification, and continuing medical education. *PMR*. 2009;1:740-743.
- Physicians Foundation. Health reform and the decline of physician private practice. 2010. <u>http://www.</u> <u>physiciansfoundation.org/uploads/default/Health_Reform_</u> <u>and the_Decline_of_Physician_Private_Practice.pdf</u>. Accessed June 23, 2015.
- Frenk J, Chen L, Bhutta ZA, et al. Health professionals for a new century: transforming education to strengthen health systems in an interdependent world. *The Lancet*. 2010;376:1923-1958.

- Peduzzi M, Norman IJ, Germani AC, da Silva JA, de Souza GC. Interprofessional education: training for healthcare professionals for teamwork focusing on users. *Rev Esc Enferm USP*. 2013;47:977-983.
- Institute of Medicine. Crossing the quality chasm: A new system for the 21st century. Washington DC: National Academies Press;2001. <u>http://iom.nationalacademies.org/-/</u> <u>media/Files/Report%20Files/2001/Crossing-the-Quality-</u> <u>Chasm/Quality%20Chasm%202001%20%20report%20</u> <u>brief.pdf</u>. Accessed June 23, 2015.
- James BC. Learning Opportunities for Heatlh Care. In: C Grossmann WG, L Olsen, JM McGinnis, ed. Engineering a Learning Healhtcare System. Washington DC: National Academies Press. 2011.
- Lucey CR. Medical education: part of the problem and part of the solution. JAMA Intern Med. 2013;173:1639-1643.
- Westfall JM MJ, Fganan L. Practice-based research: "Blue highways" on the NIH roadmap. JAMA. 2007;297:403-406.
- McGlynn EA, Asch SM, Adams J, et al. The quality of health care delivered to adults in the United States. N Eng J Med. 2003;348:2635-2645.
- Institute of Medicine. To err is human: Building a safer health system. Washington, DC: National Academy Press. 1999. <u>http://www.qu.edu.ga/pharmacy/development/</u> <u>documents/14ay/To Err is Human 1999 report brief.</u> <u>pdf</u>. Accessed June 23, 2015.
- Institute of Medicine. The Learning Healthcare System: a workshop summary. Olsen LA AD, McGinnis JM (eds). Washington DC: National Academies Press. 2007.
- Rothrock JF, Parada VA, Sims C, Key K, Walters NS, Zweifler RM. The impact of intensive patient education on clinical outcome in a clinic-based migraine population. *Headache*. 2006;46:726-731.
- Cosgrove DM, Fisher M, Gabow P, et al. Ten strategies to lower costs, improve quality, and engage patients: the view from leading health system CEOs. *Health Aff (Millwood)*. 2013;32:321-327.
- 20. Greene J, Hibbard JH. Why does patient activation matter? An examination of the relationships between patient activation and health-related outcomes. J Gen Int Med. 2012;27:520-526.
- 21. Coulter A. Patient engagement--what works? J Ambul Care Manage. 2012;35:80-89.

- Hibbard JH, Greene J. What The Evidence Shows About Patient Activation: Better Health Outcomes And Care Experiences; Fewer Data On Costs. *Health Aff (Millwood)*. 2013;32:207-214.
- Newhouse RP, Spring B. Interdisciplinary Evidence-based Practice: Moving from Silos to Synergy. *Nurs Outlook*. 2010;58:309-317.
- 24. Ratnapalan S, Uleryk E. Organizational Learning in Health Care Organizations. *Systems*. 2014;2:24-33.
- Interprofessional Education Collaborative Expert Panel. Core competencies for interprofessional collaborative practice. Washington, DC: Interprofessional Education Collaborative. 2011. <u>http://www.aacn.nche.edu/educationresources/ipecreport.pdf</u>. Accessed July 2, 2015.
- Thibault GE. Reforming health professions education will require culture change and closer ties between classroom and practice. *Health Aff (Millwood)*. 2013;32:1928-1932.
- Institute of Medicine. Best care at lower cost: the path to continuously learning health care in America. Smith M SR, Stuckhardt L, McGinnis M (eds). Washington DC: Institute of Medicine. 2012. <u>http://iom.nationalacademies.org/-/</u> <u>media/Files/Report%20Files/2012/Best-Care/Best%20</u> <u>Care%20at%20Lower%20Cost_Recs.pdf</u>. Accessed May 21, 2015.
- 28. Health Information and Management and Systems Society. National eHealth Collaborative Patient Engagement Framework. 2015. <u>http://files.himss.org/HIMSSorg/ NEHCLibrary/HIMSS Foundation Patient Engagement</u> <u>Framework.pdf</u>. Accessed May 15, 2015.
- 29. Proudfoot J. The future is in our hands: the role of mobile phones in the prevention and management of mental disorders. *Aust N Z J Psychiatry*. 2013;47:111-113.
- Bell GC, Crews KR, Wilkinson MR, et al. Development and use of active clinical decision support for preemptive pharmacogenomics. J Am Med Inform Assoc. 2014;21:e93-99.
- Jaspers MW, Smeulers M, Vermeulen H, Peute LW. Effects of clinical decision-support systems on practitioner performance and patient outcomes: a synthesis of highquality systematic review findings. J Am Med Inform Assoc. 2011;18:327-334.
- 32. Diamond L KJ, Sulkes D. The quality improvement education (QIE) roadmap: a pathway to our future. Alliance for Continuing Education in the Health Professions. 2015.

- 33. May C, Finch T. Implementing, Embedding, and Integrating Practices: An Outline of Normalization Process Theory. *Sociology*. 2009;43:535-554.
- Prochaska JO, DiClemente CC. Stages of change in the modification of problem behaviors. *Prog Behav Modif.* 1992;28:183-218.
- 35. Moore DE, Jr., Green JS, Gallis HA. Achieving desired results and improved outcomes: integrating planning and assessment throughout learning activities. J Contin Educ Health Prof. 2009;29:1-15.
- 36. Stead WW SJ, Fessler HE, et al. Healhtcare culture in the United States. In: Grossman C GW, Olsen L, McGinnis MJ, ed. Engineering a Learning Healthcare System. Washington DC: National Academies Press. 2011.
- Dewey J. Democracy and education: an introduction to the philosophy of education. London: Macmillan. 1926.
- Dewey J. How we think. A restatement of the relation of reflective thinking to the educative process. (revised 1982). Boston, MA: DC Heath. 1933.
- 39. Slotnick HB. Physicians' learning strategies. *Chest.* 2000;118:18S-23S.
- Lyndon A, Kennedy HP. Perinatal safety: from concept to nursing practice. J Perinat Neonatal Nurs. 2010;24:22-31.
- Russ S, Rout S, Sevdalis N, Moorthy K, Darzi A, Vincent C. Do safety checklists improve teamwork and communication in the operating room? A systematic review. *Ann Surg.* 2013;258:856-871.
- 42. Joint Commission. Sentinel event data: root causes by event type 2004-2014. <u>http://www.jointcommission.org/</u> <u>assets/1/18/Root_Causes_by_Event_Type_2004-2014.pdf</u>. Accessed June 18, 2015.
- 43. Owen JA, Schmitt MH. Integrating interprofessional education into continuing education: a planning process for continuing interprofessional education programs. J Contin Educ Health Prof. 2013;33:109-117.
- 44. Grol R, Bosch M, Hulscher M, Eccles M, Wensing M. Planning and studying improvement in patient care: the use of theoretical perspectives. *Milbank Q*. 2007;85:93-138.
- 45. Lowe MM, Aparicio A, Galbraith R, Dorman T, Dellert E. The future of continuing medical education: effectiveness of continuing medical education: American College of Chest Physicians Evidence-Based Educational Guidelines. *Chest.* 2009;135(3 Suppl):69S-75S.

- Begun JW, Zimmerman B, Dooley K. Health care organizations as complex adaptive systems. In: Mick SM, Wyttenbach M, (eds). Advances in Health Care Organization Theory. San Francisco Jossey-Bass; 2003:253-288.
- Berwick DM. The Science of Improvement. JAMA. 2008;299:1182-1184.
- 48. Plsek PE. The challenge of complexity in health care. *BMJ*. 2001;323:746-749.
- 49. Crosskerry P. Context is everything or how could I have been that stupid? *Healthc Q.* 2009;12:e171-e176.
- 50. Eyal N. Hooked: How to Build Habit-Forming Products. Nir Eyal. 2014.
- Nilsen P, Roback K, Brostrom A, Ellstrom P-E. Creatures of habit: accounting for the role of habit in implementation research on clinical behaviour change. *Implement Sci.* 2012;7:53.
- 52. Thalter RH SC. Nudge: Improving Decisions about Health, Wealth, and Happiness. London: Penguin. 2009.
- 53. Osheroff JA TJ, Middleton B, et al. A Roadmap for National Action on Clinical Decision Support. J Am Med Informat Ass. 2007;14:141-145.
- 54. Grunwald M. How Obama is using the science of change. *Time.* 2009;April 13:28-32.
- 55. Dopson S Fitzgerald L, Ferlie E, Gabbay J, Locock L. No magic targets! Changing clinical practice to become more evidence based. *Health Care Manage Rev.* 2002;27:35-47.
- 56. Hess DW, Reed VA, Turco MG, Parboosingh JT, Bernstein HH. Enhancing provider engagement in practice

improvement: a conceptual framework. *J Contin Educ Health Prof.* 2015;35:71-79.

- Olson CA, Tooman TR, Alvarado CJ. Knowledge systems, health care teams, and clinical practice: a study of successful change. *Adv Health Sci Educ Theory Pract.* 2010;15:491-516.
- Balmer JT. The transformation of continuing medical education (CME) in the United States. Adv Med Educ Pract. 2013;4:171-182.
- 59. Cervero RM. Place matters in physician practice and learning. *JCEHP*. 2003;23:S10-S18.
- 60. May CR, Mair FS, Dowrick CF, Finch TL. Process evaluation for complex interventions in primary care: understanding trials using the normalization process model. *BMC Fam Pract.* 2007b;8:42.
- Olson CA, Shershneva MB, Brownstein MH. Peering inside the clock: using success case method to determine how and why practice-based educational interventions succeed. *J Contin Educ Health Prof.* 2011;31 Suppl 1:S50-59.
- 62. Olson CA Tooman TR. Didactic CME and practice change: don't throw that baby out quite yet. *Adv Health Sci Educ Theory Pract.* 2012;17:441-451.
- 63. Ogrinc G, Mooney SE, Estrada C, et al. The SQUIRE (Standards for QUality Improvement Reporting Excellence) guidelines for quality improvement reporting: explanation and elaboration. *Qual Saf Health Care.* 2008;17 (Suppl 1):i13-i32.