The future state of clinical data capture and documentation: a report from AMIA's 2011 Policy Meeting

Caitlin M Cusack,[1] George Hripcsak,[2] Meryl Bloomrosen,[3] S Trent Rosenbloom,[4] Charlotte A Weaver,[5] Adam Wright,[6] David K Vawdrey,[2] Jim Walker,[7] Lena Mamykina[2]

[1]Insight Informatics, Manchester, New Hampshire, USA
[2]Department of Biomedical Informatics, Columbia University, New York, New York, USA
[3]AMIA, Bethesda, Maryland, USA
[4]Department of Biomedical Informatics, Vanderbilt University Medical Center, Nashville, TN USA
[5]Gentiva Health Services, Gentiva Inc, Atlanta, Georgia, USA
[6]Department of Medicine, Brigham and Women's Hospital, Harvard Medical School, Boston, MA, USA
[7]Geisinger Health System, Danville, Pennsylvania, USA

Correspondence to
Meryl Bloomrosen, Public Policy and Government Relations, AMIA, 4720 Montgomery Lane Suite 500, Bethesda, MD 20814, USA; meryl@amia.org

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ABSTRACT

Much of what is currently documented in the electronic health record is in response toincreasingly complex and prescriptive medicolegal, reimbursement, and regulatory requirements. These requirements often result in redundant data capture and cumbersome documentation processes. AMIA's 2011 Health Policy Meeting examined key issues in this arena and envisioned changes to help move toward an ideal future state of clinical data capture and documentation. The consensus of the meeting was that, in the move to a technology-enabled healthcare environment, the main purpose of documentation should be to support patient care and improved outcomes for individuals and populations and that documentation for other purposes should be generated as a byproduct of care delivery. This paper summarizes meeting deliberations, and highlights policy recommendations and research priorities. The authors recommend development of a national strategy to review and amend public policies to better support technology-enabled data capture and documentation practices.

INTRODUCTION

Since 2006, AMIA has convened an annual invitational Health Policy Meeting to examine emerging issues linking healthcare and health information technology (health IT) policy. The overarching objective of each meeting has been to further a national understanding of important topics in this domain and inform subsequent public policy deliberations and decisions. Previous meetings have focused on innovation challenges in health IT and informatics; unintended consequences of health IT and policy; informatics-enabled evidence-based care; and development and advancement of a national framework for health data use. Each meeting has identified policy recommendations and highlighted areas for further study and research. Post-meeting outputs have included reports, published in *JAMIA,* synthesizing conference outcomes.[1–5] As described in this paper, AMIA's 2011 Health Policy Meeting focused on the current state of technology-enabled clinical data capture and documentation in the hope of shaping these key healthcare processes in the future.

Background and significance

Discussions about the future of clinical data capture and documentation should be viewed within the overall context of trends in the healthcare arena. Key aspects of this context include a vision for the transformation of the US healthcare system into a 'learning healthcare system'; the ramp-up of electronic health records (EHRs) into an essential technology for healthcare improvement; and a growing system-wide emphasis on securing better health outcomes for both individuals and populations. A 'learning healthcare system', as defined in a 2007 Institute of Medicine (IOM) report, is '… designed to generate and apply the best evidence for the collaborative healthcare choices of each patient and provider; to drive the process of discovery as a natural outgrowth of patient care; and to ensure innovation, quality, safety, and value in healthcare'.[6]

Among the key prerequisites for the learning system is the '… comprehensive deployment and effective application of the full capabilities available in EHRs …'.[7] A 2010 IOM workshop focused on clinical data as the knowledge generation engine that could provide the foundation for national efforts to transform health and healthcare.[8] Shifts toward the next generation of health records that will yield the rich data to power this engine are currently underway. From the 1997 IOM report that found a long list of uses for EHRs[9] to the 2010 report by the National Center for Health Statistics citing increased uptake[10] to the 2012 announcement by the US Department of Health and Human Services (DHHS) that the EHR Incentive Program has spurred more than 100 000 healthcare professionals to use EHRs,[11] evidence is growing that adoption and use of EHRs is gathering speed throughout the healthcare system.

Concurrent with these trends is the nationwide focus on improving healthcare quality, reducing costs and, ultimately, achieving better patient outcomes.[12] EHRs play a key role in these efforts by providing access to data that can improve individual care as well as support clinical research, quality improvement efforts and the achievement of public health objectives—all of which work towards system-wide improvement of outcomes.[13]

Evolution of health record documentation

Very early medical and health records can be found in ancient Egyptian papyri[14 15]; today's health records are in transition from paper to an electronic format. This transition is enabling the inclusion of multimedia elements in addition to clinical chart information, allowing mining of EHR data using sophisticated semantic and statistical techniques, and fostering experimentation with new approaches such as the integration of streaming media into EHRs.[16 17]

Historically, patients' health records ideally contained comprehensive health information including medical and family history, list of recent symptoms, list of past and current medications, physical examination findings, results from diagnostic tests, clinicians' assessments, and therapeutic procedures.[18–20] Clinical data capture and documentation refer to the processes of eliciting and recording clinical histories, findings, observations, assessments, care interventions, and care plans in an individual's health record. The main purposes of these functions are to support and enhance health and healthcare by facilitating clinical reasoning and decision making by individual clinicians and allied health practitioners, and by promoting communication and coordination within and across clinical teams, ideally with patients as part of the care team.

There are concerns that documentation processes, practices, and requirements are heavily and inappropriately focused on payment and regulatory requirements rather than on care delivery, health promotion, and prevention.[21–23] Much of what is currently documented and contained in the health record responds not to clinical needs but, instead, to diverse and increasingly complex and prescriptive medicolegal, reimbursement, accreditation, and regulatory requirements. Data capture and documentation processes are influenced strongly by multiple layers of federal and state regulations and private sector requirements and mandates such as health services utilization review, quality reporting, accreditation, payment justification, and licensure. This often results in redundant data capture and cumbersome documentation processes. A recent addition to the documentation burden is the requirement engendered by the Centers for Medicare & Medicaid Services' (CMS) incentive payments for the Meaningful Use (MU) of EHRs to report specific data elements for MU objectives and clinical quality measures.[24]

The transition from paper to electronic documentation has introduced fundamental changes as existing paper-based practices are being adapted to an electronic environment. Increasing adoption and use of EHRs has raised concerns that the paradigm for electronic data capture and documentation is overly determined by the historical model of paper-based documentation,[25] and that suboptimal documentation practices in the paper world will be propagated to the electronic world.

To realize the full potential envisioned by the IOM of the shift from paper to EHRs will require addressing fundamental issues: sorting out the different roles of documentation within a technology-enabled environment; determining what data are key to creating a vibrant learning healthcare system that is focused on securing better patient outcomes; identifying how electronic documentation of key data can best be integrated into clinical workflow; and clarifying the roles of care team members, including the patient, in creating and accessing the electronic record.

Previous studies of electronic clinical data capture and documentation

Previous research has focused on the potential value of electronic data capture and documentation as well as on the challenges they pose. This section provides selected highlights of recent work with an emphasis on workflow, documentation value and quality issues, and collaborative potential.

Workflow

Considering the shift to electronic documentation, Weed described the need for electronic tools that 'reveal the actions and thought processes of providers', adding that such tools 'would permit corrective feedback loops and quality control'.[26] It is impossible to develop documentation tools that fit within clinicians' work patterns unless those patterns are understood and acknowledged. Clinicians spend much of their daily working time on documentation.[27–29] Electronic documentation allows faster and more complete access to the patient record.[30] However, most studies assessing time efficiency have noted a substantial increase in time spent documenting by physicians when using an EHR compared with paper.[31] Others have reported changes to workflow and an adverse effect on documentation quality, particularly as a result of the introduction and propagation of errors due to copy-and-paste.[32–35] Where concise progress notes were once the norm, they may now contain many pages of laboratory test results, complete reports of radiographic studies, and detailed dispensing instructions for outpatient medications. Mixed results are reported for nursing. A consistent finding, however, is that, where nursing documentation efficiencies were found, these tended to be mitigated by the addition of new computer-related tasks.[31 36 37]

Discussing the ability to obtain reusable data from EHR systems, Rosenbloom *et al*[38 39] examined the tension between expressivity and structured clinical documentation, considered ways to extract reusable data from clinical notes, and recommended that clinicians choose how to document patient care based on their workflow and note content needs. One method of understanding clinical note writing workflow is to study what is not being documented within formal clinical notes. Instead of progress notes that are an official part of the patient record, clinicians often rely on unofficial parallel forms of daily documentation such as 'sign out' notes in their day-to-day care of their patients. It is likely that a substantial amount of important clinical activity that never becomes part of the formal health record is captured in these informal paper documents. For example, clinical 'to-do' lists are commonly used to keep track of important care plan items and to facilitate the hand-off of clinical responsibilities.[40]

Value and quality of documentation

Stetson *et al* noted that documents are created for many different purposes and their value and quality may be assessed using different metrics that may not be compatible. For example, a note might be written to inform a colleague about the clinical status of a patient without concern that it generates a 'comprehensive bill'. Thus, it might be deemed of high value with respect to clinical communication but poorly compliant and not supportive of billing or utilization review or clinical quality measures.[41] Others have discussed the challenges to quality associated with excessive clutter and wrong information stored in electronic notes.[33 34] Several investigators have analyzed detailed EHR system usage logs to determine how clinical documentation and data are used after they have been stored in the EHR.[40 42–45] An analysis by Hripcsak *et al* showed that about 16% of attending physicians' notes, 8% of resident physicians' notes, and 38% of nurses' notes were never read by anyone at all; however, it also revealed that clinical notes are sometimes viewed in the EHR months or even years after they are authored, buttressing the argument for persistent storage of, and access to, historical health information. The study did not shed light on which notes should be read by other members of the care team or what proportion of documentation was captured primarily for medicolegal, administrative, or research purposes.[46]

One of the benefits of electronic data capture and documentation is the potential to provide clinical decision support. However, East *et al*[47] and Nelson *et al*[48] have described problems

with data accuracy and timeliness as major challenges for computerized decision support applications. Vawdrey *et al*[49] assessed the quality of EHR documentation in the intensive care setting by measuring the percentage of time that manually-recorded and automatically-acquired data sources matched, as well as the charting delay (the interval between an individual collecting a measurement, such as a patient's blood pressure, and entering it in the EHR). Automated collection of physiological measurements and other parameters from devices such as bedside monitors, infusion pumps, and mechanical ventilators can reduce the documentation burden on clinicians and also improve the quality of data stored in EHRs.

Collaboration

Among the benefits of EHRs is the ability to foster clinical collaboration.[50] However, a 2009 National Research Council report noted that EHRs provide little cognitive support for collaboration.[51] O'Malley *et al*[52] discussed ways in which EHRs have been shown to facilitate care coordination in physician practices as well as obstacles that inhibit realization of this goal; one example of the latter is the fact that existing reimbursement policies encourage documentation of billable events in EHRs and not of care coordination activities which are not billable. MacPhail *et al*[53] reported on a qualitative multiple case study of coordination of diabetes care using EHRs in four Kaiser Permanente Medical Centers which showed that, while coordination was attained across providers, coordination challenges persisted. Chan *et al*[54] described the development of five EHR-based care coordination measures for use in primary care and specialist settings, and assessed the relevance and acceptability of the measures by primary care providers.

AMIA'S 2011 HEALTH POLICY MEETING

Because of the importance of high quality documentation and data in supporting patient care, and given current initiatives encouraging EHR adoption and use, it is crucial to understand how documentation and data capture processes and related policies may be impacted by 'going electronic'. The goals of the 2011 Health Policy Meeting were the following:

- Articulate a vision of the future ideal state of clinical data capture and documentation in a technology-enabled environment.
- Consider the strengths and weaknesses of current approaches to electronic clinical data capture and documentation from multiple stakeholder perspectives and identify knowledge gaps and research priorities.
- Formulate policy recommendations to stakeholders to foster the realization of an ideal future state of clinical data capture and documentation that fully supports achievement of improved patient outcomes.

The meeting convened on December 6–7, 2011 in the metropolitan Washington, DC area. In the months leading up to the meeting, a Steering Committee comprised of AMIA members who are experts in the field set the meeting goals, prepared the agenda, and made suggestions about discussants, presenters, and attendees. The nearly 100 attendees included representatives from various segments of the health IT and informatics fields including providers, academicians, technology vendors, specialty societies, pharmaceutical companies, consulting firms, researchers, government agencies, and consumer advocates.

Plenary sessions provided context for the discussions and helped participants to focus on key issues in the dynamic area of technology-enabled data capture and documentation. Speakers included Jon White, Director, Health Information Technology (Health IT) Portfolio, Agency for Healthcare Research and Quality (AHRQ) and Farzad Mostashari, National Coordinator, Office of the National Coordinator for Health Information Technology (ONC). A panel discussion on research and innovation in this field featured presentations by Jim Cimino, Chief, Laboratory for Informatics Development, NIH Clinical Center; Bethany Daily, Administrative Director, Peri-Operative Strategic/Business Initiatives, Massachusetts General Hospital; and Hal Wolf, Senior Vice President and Chief Operating Officer, Kaiser Permanente.

Plenary sessions were followed by facilitated breakout discussions designed to help participants focus ideas, summarize comments and formulate recommendations, and action items. During the breakouts, participants explored the ways in which recording data for multiple purposes competes with the fundamental purpose of documentation of supporting sound clinical care. They highlighted the shortcomings of current approaches that impede efficient data capture and presentation, fall short of accurately representing clinicians' thinking, and fail to accommodate clinical workflow. Breakout sessions also focused on ways in which advancing technologies are affecting documentation and data capture, and the role of policy in driving innovative change in the health record that will yield improvements in terms of data input and output. The sessions helped formulate potential recommendations to government, industry, academia, and other stakeholders that could enable the realization of the ideal state of electronic clinical data capture and documentation.

Meeting products

The major products of the meeting (see below) were policy-oriented recommendations and a suggested research agenda to strengthen the evidence base related to clinical data capture and documentation. Additionally, participants reviewed and refined a set of proposed principles (box 1), developed by the Steering Committee before the meeting, to guide the future evolution of high value data capture and documentation. Participants also discussed strategies to promote widespread dissemination and application of the principles.

Meeting participants also reviewed a proposed set of descriptors for high quality information that had been developed by the Steering Committee in advance of the meeting. These attributes include high sensitivity[i] (all of the information needed by the patient's care team is created and recorded) and high specificity (information that is not needed by the care team is not displayed); cogency (information is created and recorded in ways to make it easy to read, process, and act on by humans and computers); and actionability (information helps guide the patient's team in executing effective, safe, efficient, and satisfying interventions. Being actionable includes being computable, for example, in clinical prediction rules when appropriate to the patient's needs). While high sensitivity and high specificity are attributes of high quality information, it should also be noted that they are context-dependent. For example, an item of information might be highly useful and should be displayed to a decision maker when a diagnosis is being established, but of lower usefulness and should be hidden when management or disposition is the task at hand. Further refinement of these descriptors is needed to reflect these nuances.

[i]Sensitivity is used here in a statistical or epidemiological sense rather than referring to 'sensitive' patient information that is subject to privacy concerns.

Box 1 Proposed guiding principles for clinical data capture and documentation

Clinical data capture and documentation should:

1. Be clinically pertinent, patient-centric, and represent an individual's lifetime health and healthcare.
2. Support capture of high quality information that is accurate, relevant, confidential, reliable, valid, complete, and secure.
3. Be efficient and usable while enhancing the healthcare organization's and the care team's overall efficiency, effectiveness and productivity.
4. Support multiple downstream uses as a byproduct of the recording of care delivery including quality measurement, performance improvement, population health care delivery, policymaking, research, education, and reimbursement.
5. Enable joint patient-provider decision making, team collaboration, care process management, and advanced clinical decision support.
6. Enable collection of data and interpretation of information from multiple sources as appropriate and necessary, including nuanced medical discourse, structured items, and data captured in other systems and devices.
7. Automation of data capture and documentation should be optimized whenever appropriate, allowing human beings to focus on gathering and entering data that cannot be effectively collected by automated tools (eg, automated acquisition of data from biomedical devices).

Meeting findings and recommendations: policy and research

Meeting participants concluded that high value documentation is important to—and representative of—high quality patient care. The consensus among participants was that, in the move to a technology-enabled healthcare environment, the main purposes of documentation should continue to be to support and enhance patient care by facilitating clinical reasoning and decision making of individual clinicians and by supporting team communication and coordination, with the inclusion of the patient. However, participants recognized that, given the growing complexity of care delivery and advances in heath IT and informatics, there is a need to transform the way we capture and document clinical care. To some extent, the industry has failed to exploit technology in ways that would help to capture and present healthcare data. With some reimbursement methods at least partially based on the amount of documentation, there is an incentive to document extensively. This leads to duplicate information, 'captured' repetitively, without any resultant improvement in the provision of care. Because more efficient patient assessment and information capture may have the potential to reduce payment, there is little incentive to explore alternative data capture or documentation practices.

Key findings and public policy recommendations discussed by meeting participants and refined by the authors are outlined below. The authors propose that public and private sector organizations work together to implement these recommendations.

1. **Finding.** The fundamental purpose of clinical data capture and documentation in a technology-enabled environment must be the direct support of health and healthcare. Other purposes such as performance measures, quality reporting, payment, and legal requirements have encroached upon this central purpose.
   - **Recommendation.** The Federal government should lead a public-private sector initiative to propel a transformational shift away from the longstanding emphasis on 'payment-focused' data capture and documentation towards an approach that focuses on quality, safety, and good outcomes of care. This shift must consider future approaches to payment and care delivery such as those associated with Accountable Care Organizations (ACOs), patient-centered medical homes, and bundled payments.
2. **Finding**. The Proposed Guiding Principles for Clinical Data Capture and Documentation, a product of the meeting (box 1), is a first step towards establishing benchmarks for the future evolution of these critical healthcare functions.
   - **Recommendation.** The DHHS should lead an effort to promote widespread public and private sector vetting of the proposed principles followed by healthcare system-wide adoption of an agreed-upon version of them. Agencies such as AHRQ, Centers for Disease Control and Prevention (CDC), Health Resources and Services Administration (HRSA), Indian Health Service (IHS), ONC, and the Department of Veterans Affairs should be involved in vetting and dissemination activities.
3. **Finding.** The expectation that the EHR should serve as a repository for a wide variety of data elements, many of which are unrelated to direct patient care, is outpacing the ability of data providers to efficiently and effectively collect and enter such data. New data reporting and/or documentation requirements frequently require changes to organizational and health IT infrastructures and processes. The evidence base for such requirements is not always apparent, nor is it always clear what the benefits of the new requirements are, and to whom benefits accrue. Data capture and documentation should align with and not impede the care team's workflow and care delivery; indeed, it should support improvement in work processes. To the extent possible, documentation needed to support purposes other than direct patient care should be generated automatically as a byproduct of healthcare delivery.
   - **Recommendation.** Clinical data capture and documentation requirements should be reviewed on a regular basis, with outdated ones revised or removed as needed. The agencies and organizations responsible for current governmental and organizational requirements should align and harmonize them to reduce data capture and documentation burdens. Examples of these requirements include MU, EHR certification, Medicare Conditions of Participation, National Quality Forum quality reporting measures, Food and Drug Administration (FDA) regulations, CDC public health reporting, AHRQ quality reporting, The Joint Commission, and state rules and regulations. Existing requirements under HIPAA that promote more uniform data capture and documentation should be enforced.
4. **Finding.** Clinicians in different subspecialties and venues have different workflows during which documentation is carried out. EHR usability and functionality must improve to align with these diverse workflows across multiple venues and providers.
   - **Recommendation.** Developers of electronic documentation tools and EHRs must consider where and how clinical data are captured and documentation is recorded, such as during teaching rounds, on a cell phone, in a private office, at a shared computer at the nurse's station, via a telehealth or medical device, or in the patient's home. EHR design

elements should accommodate these differences. MU and EHR certification criteria should recognize such differences.

5. **Finding.** Clinical data capture and documentation paradigms must facilitate multidisciplinary team-based care, coordination, and delivery. The transition from paper to electronic documentation can reveal and sometimes exacerbate barriers to team communication. At the same time, increased adoption and use of health IT may spark increased attention to administrative, clinical, and workflow process improvements that can help overcome some of these barriers.
   - **Recommendation**. The multidisciplinary 'team' encompasses everyone who provides care to the patient in whatever venue the care is provided, (eg, clinic, hospital, home, long-term care facility, school, and hospice). Where possible and permitted by external and institutional regulations, clinical documents should accommodate data entered by the most appropriate team member; where not currently permitted by existing regulations, policymakers should consider modifications to existing regulations and potential alternative approaches to allow this. Developers of EHRs and electronic data capture and documentation systems should incorporate role-specific user interfaces in these tools to help each member of the care team create and record the data needed to support high quality, high efficiency, satisfying care processes—regardless of time and user location.
6. **Finding.** The patient must be a key member of the care team. As the emphasis shifts to increased involvement of patients in their care and in creating their own health records, there will be a growing need to help these non-clinical members of the care team gain health literacy so that their contributions will be meaningful.
   - **Recommendation**. The individual-centered health record, facilitating an individual's engagement in health promotion and disease management, should be embraced by stakeholders in all sectors of the healthcare system. Individuals and their designees should be able to view, recommend changes to, and contribute directly to the health record, with the provenance of the data clearly noted. Patient-entered data could start with high value data that patients can often enter as well or better than providers, such as their family history; patient goals should be entered and translated into clinical goals and actions.
   - **Recommendation.** Efforts to raise the health literacy of individuals, their caregivers, and their families must be a higher public policy priority than it currently is so that they can participate effectively as members of their healthcare team. DHHS should create and deploy a national educational program/resource to engage and educate patients and their families, including information on how patients can contribute to and use their health data and documentation. Agencies such as AHRQ, ONC, and the National Library of Medicine should be involved in these education activities. Current programs such as the CMS Partnership for Patients could be leveraged for such an effort.
7. **Finding.** Clinicians often have different goals and motivations for authoring notes, including documenting clinical care, communicating with the clinical care team, fulfilling training requirements, justifying billing, meeting regulatory requirements, and creating a record that they believe will help protect them from a medicolegal perspective. Amid a continually shifting political and technology landscape, it appears that providers may be misinterpreting regulatory, payment and legal requirements. Such misunderstandings may result in unnecessary data capture and documentation practices. In particular, clinicians' concerns about perceived legal liabilities and malpractice may be overly influencing the quality, content, and amount of data capture and documentation.
   - **Recommendation.** Educators should develop new approaches to teaching students in clinical and allied health professions about clinical data capture and documentation. There is a need to harmonize how and when students learn about and practice these key tasks. The ethos of training should be changed from 'what if I miss something?' to 'how do I learn precision in information collection and documentation?' In addition, research should be undertaken to determine the extent to which clinicians and allied health professionals are overly influenced by perceived legal liabilities and malpractice concerns.

Research agenda recommendations

Meeting participants highlighted several important questions and gaps in the evidence base pertaining to data capture and documentation that need to be addressed by additional research:

- In-depth understanding of clinician workflow patterns and cognitive needs as related to documentation.
- Measurement of burden on clinicians of specific (and cumulative) data reporting and documentation requirements.
- Potential risks to patient safety from documentation practices.
- Dynamics involved in team-based care and the role of electronic information systems in supporting care coordination within and among care teams and venues.
- Impact of new data sources on documentation and data capture processes.

Below are recommendations for research activities to address these and other pressing questions related to data capture and documentation:

1. **Clinicians' cognitive needs with respect to documentation.** Funding agencies should encourage studies to gain a deeper understanding of the cognitive needs of clinicians with respect to information flow and documentation. Applying knowledge gained about cognition, DHHS should fund the development of innovative automated documentation tools, including data input methods that accommodate entry by various methods such as dictation with or without voice recognition, digital handwriting, and document scanning with or without optical character recognition. Other approaches to help reduce documentation burdens include development of improved usability interfaces and tools (eg, dashboards that show changes in patient state); new methods for data transformation; use of natural language processing of textual information; automated acquisition of data from biomedical devices; cloud-based approaches; and collaborative documentation paradigms. Comparative effectiveness studies should address nuances of data capture and interpretation (eg, comparing voice recognition technologies with template-driven documentation).
2. **Documentation burden of data reporting requirements**. DHHS continues to implement requirements for data reporting including public health and performance measures as well as data related to MU of health IT. Federal health agencies such as AHRQ, CDC, FDA, and ONC should explore the feasibility of new data or documentation requirements and assess the potential burden on the documenter/data provider prior to the implementation of new ones. Any related

policy changes should be informed by such research and the implications of the evidence.

3. **Relationship of electronic data capture and documentation processes and practices to patient safety and quality of care issues.** The evolution of clinical data capture and documentation practices in a technology-enabled environment will necessitate a coordinated effort by all stakeholders to increase understanding of and closely monitor associated risks to patient safety. For example, research is needed to compare the quality of data and the quality of clinical documentation between paper charts and EHRs. Furthermore, it is not clear the extent to which electronic data capture and documentation processes will have a measurable beneficial impact on care delivery. Other data are needed to confirm how and under what circumstances electronic data capture and documentation processes can facilitate team-based care initiatives and care coordination innovations.
4. **Re-use of data via computerized systems.** Given the recognized need to maximize re-use of data, DHHS should fund additional research to demonstrate how computer systems (eg, through automated transformation of data) can help maximize the organization and presentation of data for various users and purposes. For example, research could focus on how data can be entered once, with systems providing different outputs and views of the data for different users and purposes.
5. **Dynamics of team-based clinical care and the role of technology-enabled documentation in supporting care coordination.** AHRQ should fund studies to help gain a better understanding of what a 'team' means in the healthcare context: for example, clarifying who is a member of the healthcare team and defining their roles and responsibilities with respect to data capture and documentation. The extent to which technology can be leveraged to support team-based care and associated workflows requires further study. The CMS Center for Medicare and Medicaid Innovation should include funding for demonstrations on data capture and documentation within team-based care, including safe havens from conditions of participation.
6. **Impact of integrating emerging data sources into documentation processes and outputs**. Future clinical data capture and documentation methods, systems, and approaches must accommodate and leverage diverse and increasingly large data sets, including genomic and patient-reported data, and data derived from mHealth and telehealth applications. Research is needed to develop new tools for representation, visualization, and summarization of these types of data. Topics for additional study include whether and to what extent automatically acquired data are more timely, accurate, and reliable than manually charted data; the ramifications for data capture and documentation processes as new data sources are connected to/integrated with EHRs; and review of public policy guidelines and requirements for data capture and documentation in light of data generated by new devices and technologies.

CONCLUSIONS

AMIA's 2011 Health Policy Meeting examined current issues related to clinical data capture and documentation and took the long look ahead to envision changes that would help realize an ideal future state of these functions. Thoughtful consideration by diverse stakeholders of the strengths and weaknesses of current approaches led to the identification of knowledge gaps and policy and research priorities, as described in this paper.

Technological advances in the documentation sphere will continue to emerge to enable the inclusion of increasingly sophisticated data—for example, capture and integration of genomic information in the EHR to help propel personalized medicine.[55–57] While technology will make futuristic data capture opportunities possible, attention must continue to be paid to the core issues discussed during the meeting that are central to a learning healthcare system using a computer-based infrastructure. These include the need for data capture and presentation methods that support clinicians' cognitive needs and workflow; the inclusion of the high quality data in the electronic record necessary to undergird national strategies to achieve better health outcomes for individuals and populations; and use of EHR documentation to support holistic approaches such as multidisciplinary team-based care and enhanced participation by patients in promoting health and treating illness.

AMIA Board of Directors' response and action

By convening this meeting and disseminating this report, AMIA has identified technology-enabled clinical data capture and documentation as a critical issue in national efforts to achieve high quality health and healthcare. The AMIA Board of Directors reviewed this paper and endorsed the authors' recommendations. The Board of Directors anticipates committing additional organizational resources to continue to advance the work of the meeting and will encourage other organizations to work collaboratively to pursue the recommendations and to continue this important public discourse.

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REFERENCES

1. **McGowan JJ,** Cusack CM, Bloomrosen M. The future of health IT innovation and informatics: a report from AMIA's 2010 policy meeting. *J Am Med Inform Assoc* 2012;**19**:460–7.
2. **Bloomrosen M,** Starren J, Lorenzi NM, *et al*. Anticipating and addressing the unintended consequences of health IT and policy: a report from the AMIA 2009 Health Policy Meeting. *J Am Med Inform Assoc* 2011;**18**:82–90.
3. **Bloomrosen M,** Detmer DE. Informatics, evidence-based care, and research; implications for national policy: a report of an American Medical Informatics Association health policy conference. *J Am Med Inform Assoc* 2010;**17**:115–23.
4. **Safran C,** Bloomrosen M, Hammond WE, *et al*. Toward a national framework for the secondary use of health data: an American Medical Informatics Association White Paper. *J Am Med Inform Assoc* 2007;**14**:1–9.
5. **Bloomrosen M,** Detmer D. Advancing the framework: use of health data—a report of a working conference of the American Medical Informatics Association. *J Am Med Inform Assoc* 2008;**15**:715–22.
6. **Olsen LA,** Aisner D, McGinnis JM; Roundtable on Evidence-Based Medicine, Institute of Medicine. *The learning healthcare system: workshop summary*. Washington, DC: National Academies Press (US), 2007:353. http://www.nap.edu/openbook.php?record_id=11903&page=R1 (accessed 16 Jul 2012).
7. **Olsen LA,,** Aisner D, McGinnis JM; Roundtable on Evidence-Based Medicine, Institute of Medicine. *The learning healthcare system: workshop summary*. Washington, DC: National Academies Press (US), 2007:5. http://www.nap.edu/openbook.php?record_id=11903&page=R1 (accessed 16 Jul 2012).
8. **Goolsby WA,** Olsen L, McGinnis M; IOM Roundtable on Value and Science-Driven Health Care. *Clinical data as the basic staple of health learning: creating and protecting a public good: workshop summary*. Washington, DC: National Academies Press (US), 2010. http://www.nap.edu/catalog.php?record_id=12212 (accessed 16 Jul 2012).

9. **Dick RS,** Steen EB, Detmer DE; Committee on Improving the Patient Record, Institute of Medicine. *An essential technology for health care*. Revised edn. Washington, DC: National Academies Press (US), 1997. http://www.nap.edu/openbook.php?record_id=5306 (accessed 16 Jul 2012).
10. **Hsaio CJ,** Hing E, Socey TC, *et al*. Electronic medical record/electronic health record systems of office-based physicians: United States, 2009 and preliminary 2010 state estimates. National Center for Health Statistics Health E-Stat. December 2010. http://www.cdc.gov/nchs/data/hestat/emr_ehr_09/emr_ehr_09.htm (accessed 16 Jul 2012).
11. **US Department of Health and Human Services.** News release. More than 100 000 health care providers paid for using electronic health records. June 19, 2012. http://www.hhs.gov/news/press/2012pres/06/20120619a.html (accessed 16 Jul 2012).
12. **US Department of Health and Human Services.** News release. HHS awards $17 million for patient-centered outcomes research. September 1, 2010. http://www.hhs.gov/news/press/2010pres/09/20100901b.html (accessed 16 Jul 2012).
13. **Gluck ME.** Academy Health. Early glimpses of the learning health care system: the potential impact of health IT. March 2012. http://www.academyhealth.org/files/publications/HIT4AKPotential.pdf (accessed 16 Jul 2012).
14. **Kamp MA,** Tahsim-Oglou Y, Steiger HJ, *et al*. Traumatic brain injuries in ancient Egypt: insights from the Edwin Smith Papyrus. *Cen Eur Neurosurg* 2012 Jan 23. Epub ahead of print.
15. **Jungraithmayr W,** Weder W. Chest surgical disorders in ancient Egypt: evidence of advanced knowledge. *Ann Surg* 2012;**255**:605–8.
16. **Dayhoff RE,** Kuzmak PM, Frank S. The multimedia electronic patient record: current issues. AMIA Annu Symp Proc; 2003:1063.
17. **Chen W,** Shih CC. Architecture of portable electronic medical records system integrated with streaming media. *J Med Syst* 2012;**36**:25–31.
18. **Engle RL Jr**. The evolution, uses, and present problems of the patient's medical record as exemplified by the records of the New York Hospital from 1793 to the present. *Trans Am Clin Climatol Assoc* 1991;**102**:182–9.
19. **Rosenbloom ST,** Kiepek W, Belletti J, *et al*. Generating complex clinical documents using structured entry and reporting. *Stud Health Technol Inform* 2004;**107**(Pt 1):683–7.
20. **Siegler EL.** The evolving medical record. *Ann Intern Med* 2010;**153**:671–7.
21. **Wasserman RC.** Electronic medical records (EMRs), epidemiology, and epistemology: reflections on EMRs and future pediatric clinical research. *Acad Pediatr* 2011;**11**:280–7.
22. **Hagland M.** Balancing act: can CMIOs and CIOs make physician documentation work for everyone? *Healthc Inform* 2011;**28**:8–10, 12, 14.
23. **Keenan GM,** Yakel E, Tschannen D, *et al*. Documentation and the nurse care planning process. In: Hughes RG, ed. *Patient safety and quality: an evidence-based handbook for nurses*. Rockville, MD: Agency for Healthcare Research and Quality (US), 2008, Chapter 49.
24. **CMS.gov**. EHR incentive programs. August 27, 2012. https://www.cms.gov/Regulations-and-Guidance/Legislation/EHRIncentivePrograms/index.html?redirect=/ehrincentiveprograms/ (accessed 31 August 2012).
25. **Sujansky WV.** The benefits and challenges of an electronic medical record: much more than a "word-processed" patient chart. *West J Med* 1998;**169**:176–83.
26. **Weed LL.** New connections between medical knowledge and patient care. *BMJ (Clin Res Ed)* 1997;315:231–5.
27. **O'Leary KJ,** Liebovitz DM, Baker DW. How hospitalists spend their time: insights on efficiency and safety. *J Hosp Med (Online)* 2006;**1**:88–93.
28. **Ammenwerth E,** Spotl HP. The time needed for clinical documentation versus direct patient care. A work-sampling analysis of physicians' activities. *Methods Inf Med* 2009;**48**:84–91.
29. **DesRoches C,** Donelan K, Buerhous P, *et al*. Registered nurses use of electronic health records: findings from a national survey. *Medscape J Med* 2008;**10**:164–73.
30. **Embi PJ,** Yackel TR, Logan JR, *et al*. Impacts of computerized physician documentation in a teaching hospital: perceptions of faculty and resident physicians. *J Am Med Inform Assoc* 2004;**11**:300–9.
31. **Poissant L,** Pereira J, Tamblyn R, *et al*. The impact of electronic health records on time efficiency of physicians and nurses: a systematic review. *J Am Med Inform Assoc* 2005;**12**:505–16.
32. **Weir CR,** Hurdle JF, Felgar MA, *et al*. Direct text entry in electronic progress notes: an evaluation of input errors. *Methods Inf Med* 2003;**42**:61–7.
33. **Hirschtick RE.** A piece of my mind. Copy-and-paste. *JAMA* 2006;**295**:2335–6.
34. **Hartzband P,** Groopman J. Off the record—avoiding the pitfalls of going electronic. *N Engl J Med* 2008;**358**:1656–8.
35. **O'Donnell HC,** Kaushal R, Barron Y, *et al*. Physicians' attitudes towards copy and pasting in electronic note writing. *J Gen Intern Med* 2009;**24**:63–8.
36. **Gugerty B,** Maranda MJ, Beachley M, *et al*. *Challenges and opportunities in documentation of the nursing care of patients*. Baltimore: Documentation Work Group, Maryland Nursing Workforce Commission, 2007. http://www.mbon.org/commission2/documentation_challenges.pdf (accessed 16 Jul 2012).
37. **Kossman S,** Scheidenhelm SL. Nurses' perceptions of the impact of electronic health records on work and patient outcomes. *CIN* 2008;**26**:69–77.
38. **Rosenbloom ST,** Denny JC, Xu H, *et al*. Data from clinical notes: a perspective on the tension between structure and flexible documentation. *J Am Med Inform Assoc* 2011;**18**:181–6.
39. **Rosenbloom ST,** Stead WW, Denny JC, *et al*. Generating clinical notes for electronic health record systems. *Appl Clin Inform* 2010;**1**:232–43.
40. **Stein DM,** Wrenn JO, Johnson SB, *et al*. Signout: a collaborative document with implications for the future of clinical information systems. *AMIA Annu Symp Proc* 2007;**2007**:696–700.
41. **Stetson PD,** Morrison FP, Bakken S, *et al*. Preliminary development of the physician documentation quality instrument. *J Am Med Inform Assoc* 2008;**15**:534–41.
42. **Chen ES,** Cimino JJ. Patterns of usage for a web-based clinical information system. *Stud Health Technol Inform* 2004;**107**(Pt 1):18–22.
43. **Hripcsak G,** Sengupta S, Wilcox A, *et al*. Emergency department access to a longitudinal medical record. *J Am Med Inform Assoc* 2007;**14**:235–8.
44. **Natarajan K,** Stein D, Jain S, *et al*. An analysis of clinical queries in an electronic health record search utility. *Int J Med Inform* 2010;**79**:515–22.
45. **Yang L,** Mei Q, Zheng K, *et al*. Query log analysis of an electronic health record search engine. *AMIA Annu Symp Proc* 2001; **2011**;915–24.
46. **Hripcsak G,** Vawdrey DK, Fred MR, *et al*. Use of electronic clinical documentation: time spent and team interactions. *J Am Med Inform Assoc* 2011;**18**:112–17.
47. **East TD,** Henderson S, Morris AH, *et al*. Implementation issues and challenges for computerized clinical protocols for management of mechanical ventilation in ARDS patients. *Symposium for Computer Applications in Medical Care (SCAMC)* 1989;**13**:583–7.
48. **Nelson NC,** Evans RS, Samore MH, *et al*. Detection and prevention of medication errors using real-time bedside nurse charting. *J Am Med Inform Assoc* 2005;**12**:390–7.
49. **Vawdrey DK,** Gardner RM, Evans RS, *et al*. Assessing data quality in manual entry of ventilator settings. *J Am Med Inform Assoc* 2007;**14**:295–303.
50. **Halamka J.** The perfect storm for electronic health records. *J Healthc Inf Manag* 2006;**20**:25–7.
51. **Stead W,** Lin H, eds. *Computational technology for effective health care: immediate steps and strategic directions*. Washington, DC: National Academies Press, 2009.
52. **O'Malley AS,** Grossman JM, Cohen GR, *et al*. Are electronic medical records helpful for care coordination? Experiences of physician practices. *J Gen Intern Med* 2010;**25**:177–85.
53. **MacPhail LH,** Neuwirth EB, Bellows J. Coordination of diabetes care in four delivery models using an electronic health record. *Med Care* 2009;**47**:993–9.
54. **Chan KS,** Weiner JP, Scholle SH, *et al*. EHR-based care coordination performance measures in ambulatory care. The Commonwealth Fund Issue Brief. November 18, 2011, Volume 25. http://www.commonwealthfund.org/Publications/Issue-Briefs/2011/Nov/EHR-Based-Care-Coordination.aspx (accessed 16 Jul 2012).
55. **Luciano JS,** Andersson B, Batchelor C, *et al*. The translational medicine ontology and knowledge base: driving personalized medicine by bridging the gap between bench and bedside. *J Biomed Semantics* 2011;**2**(Suppl 2):S1.
56. **Genome.gov**. National Human Genome Research Institute. Electronic Medical Records and Genomics (eMERGE) Network. http://www.genome.gov/27540473 (accessed 16 Jul 2012).
57. **Masys DR,** Jarvik GP, Abernethy NF, *et al*. Technical desiderata for the integration of genomic data into electronic health records. *J Biomed Inform* 2012;**45**:419–22.

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