It's Time to Wikify Clinical Documentation: How Collaborative Authorship Can Reduce the Burden and Improve the Quality of the Electronic Health Record

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Abstract

Electronic health records (EHRs) have become ubiquitous tools and represent the standard of care for 96% of hospitals and 86% of ambulatory physicians in the United States. With adoption of EHRs came the promise of improved efficiency, higher-quality care, and lower costs. Unfortunately, some clinicians are now spending twice as much time on documentation as they spend seeing patients, and the documentation paradigm of problem-oriented medical records is contributing to this imbalance. It is time to consider new innovations. The collaborative wiki format offers many opportunities to ease the burden of documentation as well as to increase the usefulness of the recorded clinical data. Wikis support multiple authorship, have built-in features to track edits and changes, allow for contextual linkages (e.g., linking medical problems to their treatment), and support new technologies such as application programming interfaces, which allow for safe and secure exchange of information. In this Perspective, the authors describe the rationale for considering this approach to clinical documentation and propose a pilot to learn about its effectiveness. They believe wiki-based documentation will become increasingly attractive, especially as new legislation and directives from policymakers seek to reduce the crushing documentation burden and as the U.S. health care system transitions from an episode-based payment structure to a value-based, outcomes-focused system.

Clinical documentation has been a cornerstone of medical care for hundreds of years, if not longer.[1] The products of such documentation, conventionally called "notes," serve many purposes: reminding the note author of what they did, communicating to other providers both in the present and the future, justifying a level of service provided and fee charged, defending decisions in case of malpractice accusations, providing data for research and quality improvement, and even communicating with patients as in OpenNotes.[2–4] The last major paradigm shift in documentation occurred in 1968, when Dr. Larry Weed proposed the problem-oriented medical record.[5] This fundamental realignment led to the now-familiar problem list and the SOAP (subjective, objective, assessment, and plan) note concept. Interestingly, Weed presaged and welcomed electronic health records (EHRs),[6] writing that "it can readily be seen that … in the future all narrative data may be entered through [a] series of displays."[5]

Now, EHRs are used by 96% of hospitals[7] and 86% of ambulatory physicians[8] in the United States. EHRs were envisioned to improve care, reduce costs, and deliver efficiency gains. Yet, the medical community is drowning in a sea of inefficient documentation. Great icebergs of "note bloat" abound, where the minority of useful information above the surface sits upon a large amount of redundancy underneath.[9,10] Modern EHRs can be conceived of as cargo ships designed to ply and ostensibly bring order to the waters. They are certainly capable of carrying a large amount of cargo, but they are not built to make loading and unloading easy. Medical residents are now spending 112 hours per month using the EHR, and more than 25% of that time is devoted to documentation.[11] A recently published study found that primary care physicians are spending nearly twice as much time on documentation as on the face-to-face patient encounter, which is contributing to burnout.[12] Ad hoc solutions to this information-overload problem, such as the APSO note (which switches the order of the SOAP note sections), may yield some short-term benefits but do not solve the fundamental problems facing clinical documentation.[13] The Centers for Medicare & Medicaid Services (CMS) Evaluation and Management (E&M) requirements,[14,15] which were originally produced in the 1990s around the same time as the birth of the Internet, continue to be the main guidance by which clinical documentation is written and enforce a fairly inflexible tie between documentation and billing.

In addition to time spent, EHR documentation is encumbered by other challenges. In the current system, each provider writes his or her own encounter-based notes, leading to redundancy, fragmentation, and lack of a single shared clinical narrative. This problem is further aggravated when a patient receives care across organizations whose EHRs are not interoperable. Redundant documentation leads to electronic notes in the United States that are nearly four times longer than those in other countries.[9] Lastly, because of specific regulations and policies around psychotherapy notes, notes relating to substance abuse treatment and similarly sensitive notes are often sequestered from the rest of the record.[16] Faced with these challenges, the practitioner may only see the flotsam and jetsam and possibly miss the boat.

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An Alternative: Wikify Documentation

While the U.S. health care system has been drowning in the encounter-based narrative model, a new model for documentation has made a splash in other information and knowledge management venues: the wiki. Although there were early models of the wiki, such as the WikiWikiWeb[17] introduced in 1994 by Ward Cunningham, the idea of a knowledge base without central organization was conceived essentially contemporaneously with the launch of Wikipedia[18] in January 2001. Wikipedia has become one of the most extensive content sources created in human history, and it is by far the most popular noncommercial site on the Internet.[19] So what does an online encyclopedia have to do with clinical documentation? Quite a bit, potentially. We believe using a wiki format for clinical documentation would offer many advantages over the traditional method of encounter-based, single-authored clinical documentation.

Wikis are collaborative and can save time

The hallmarks of the wiki format are that a single document can be as large as needed and can support multiple authors. These concepts are intrinsically related; the wiki format enables authors to build upon prior content rather than starting with a blank slate each time a document is written. In clinical settings, there may be only a small number of changes to document for a patient in any given time interval, suggesting that significant time savings could be realized by adopting a wiki format. Furthermore, in most clinical settings, there is a compelling case to be made for multiple authorship. Outpatient encounters may involve intake personnel, nurses, advanced practice practitioners, and physicians, whereas inpatient encounters may involve teams including primary doctors, consultants, nurses, care partners, and pharmacists. As a result, both brief office visits and prolonged inpatient hospitalizations can produce a proliferation of distinct documents and addenda in the EHR: intake forms, checkout forms, patient-completed questionnaires, progress notes, consultant reports, visit summaries, radiology and lab scheduling requests, consult requests, telephone calls, and so forth.

Collaborative authorship in the wiki environment, aside from consolidation, enables continuous peer review and error correction. The early concern that "bad actors" would manipulate the accuracy of collaboratively authored information has been mainly unfounded, including in the medical domain.[20,21] Some medical schools, led by the University of California, San Francisco (UCSF) School of Medicine, are offering academic credit for Wikipedia edits,[22] and Wikipedia is being used as a knowledge resource to develop high-throughput phenotyping algorithms.[23,24] Critically, wikis track each user's edits, and the capability exists to explicitly show provenance, through author tags and other means such as color coding. For example, a medical student's contributions to the patient history could be highlighted red, a pharmacist's contributions to medication reconciliation could be highlighted green, and so forth.

Wikis allow for adjudication and moderation

A common objection to use of a wiki model of collaborative authorship is that one author can overwrite or reverse other authors' contributions. This can lead to quasi-stable content, especially in controversial topics. A rough equivalent in the medical domain is jousting, where two (or more) practitioners with divergent opinions will place commentary in the medical record, which can be seen as unprofessional at best and liability inducing at worst.[25] It is unknown whether a wiki format for clinical documentation would encourage such behavior, but what is clear is that different users of a wiki can be assigned different roles, including adjudicator. An adjudicator role would likely only be assigned to one senior member of a collaborative team in any encounter. However, given the potentially time-consuming nature of adjudication, this role is often self-assigned in wiki environments. On a collaborative clinical team, a primary care physician might choose to adjudicate any documentation related to medication changes for their patient, whereas a subspecialist might choose to adjudicate notes on problems directly related to their focus area. For particular highly sensitive aspects of the record (e.g., psychiatric history), there is also the option of moderation, where any proposed content edits would have to be approved in advance. In all cases, wikis can track attribution, and history is preserved, as we will discuss below.

Wikis can be access controlled

The obverse of collaboration—with or without adjudication or moderation—is access control. In the Wikipedia environment, anyone who signs up for a free account can add, modify, or delete content. This open approach is clearly not compatible with a patient chart, which usually has safeguards in place to ensure that only certain authors may document and that documentation cannot be deleted once it is finalized. However, the wiki model allows for implementation of extensive access controls.[26] Authoring privileges can be selective and section- or page-specific. Crucially, nothing is ever actually deleted in the wiki environment, as we will discuss below.

Wikis are modular and relational

One of the core wiki concepts is that a wiki can be split into any number of separate pages, which in turn can be split into sections, subsections, and so forth. This ability allows for crisp delineation of sections of the clinical narrative. Wikis also easily accommodate any number of links that allow seamless navigation between sections and across pages. This offers functionality not present in static clinical documentation: Through wikis, medical problems can be joined to treatments or to other problems. For example, coronary artery disease can be linked to stent implantation, a bypass procedure, and specific medications. That bypass procedure can in turn be linked to the treatment-related complication of sternal wound infection. Such explicit associations of problems and their treatments would obviate the need for the problem list as it currently exists in EHRs, where it is generally disconnected from the clinical documentation, underused, and error prone.[27–29] Explicit associations would also enable a greater likelihood of causal inference in the secondary analysis of EHR data—for example, as is envisioned by the National Institute of Health Precision Medicine Initiative's All of Us Research Program.[30]

Wikis are inherently longitudinal

Another hallmark of the wiki format is that all changes are tracked and permanently archived. The primary intent of this mechanism is to allow

for rolling back (i.e., reversing) any erroneous or biased changes introduced during the collaborative authorship process, as outlined above. However, this mechanism also creates a timeline of events by time-stamping every change as it is made. For clinical documentation updated in real time, such as vital signs entered or medications changed, these time stamps would correspond directly to the events documented. When making documentation updates retrospectively because of clinic workflow constraints, the user would have to explicitly notate the event with a separate time stamp, but doing so is relatively simple.

Wikis are web accessible

In a 2011 survey of U.S. clinicians implementing EHRs, remote chart access was the most commonly reported benefit.[31] By far, the most commonly used tool to access electronic data remotely is the World Wide Web. Both unsecured wikis such as Wikipedia and secured wikis that use encryption and authentication are web accessible.

Wikis can use Semantic Web technology

The original World Wide Web, as envisioned by Tim Berners-Lee and Robert Cailliau,[32] did not rely on common data formats and exchange protocols. The "Semantic Web," an enhancement to the existing web that has been partially implemented, models content on what is known as the resource description framework.[33] Semantically enabled wikis are not simply "web pages." In essence, Semantic Web technology allows for the assignment of properties to any object using a common syntax. For example, the words "John Smith" could be labeled as a person, a patient of Dr. Barbara Jones, and insured by Medicare (three distinct properties). Such attributes allow for extensive categorization[34] of concepts as well as construction of formal ontologies. More important, in a clinical documentation wiki, these attributes allow for seamless navigation through a patient's diagnosis and treatment plans, without an excess of redundant documentation. Semantic wikis can also create automated lists (e.g., medication lists imported from source systems), visualizations (e.g., vital signs trends), and more.[35] Furthermore, semantic tags can be directly used to power apps, as we describe below.

Wikis can communicate with other online resources

One of the most powerful features of wikis is the ability to include clickable links to additional content outside the wiki. Direct links to outside websites are unlikely to be included in a clinical documentation wiki because of the inherent privacy concerns of the protected health information. An alternative is emerging quickly in the form of application programming interfaces (APIs). APIs are programs in the form of small software applications (apps) that act as go-betweens between local content and external knowledge or capabilities. APIs are what power information aggregation websites such as Expedia.com, and they are what allow third-party apps on smartphones to communicate with the core systems. APIs can offer security options that meet and exceed those required by the Health Insurance Portability and Accountability Act of 1996 (HIPAA).[36] The best-known API in the clinical domain is Substitutable Medical Apps, Reusable Technologies (SMART).[37–39] A recent enhancement, "SMART on FHIR," uses the rapidly emerging Fast Healthcare Interoperability Resources (FHIR) standard.[40] FHIR is built on the RESTful API concept,[41] which is in format very similar to the URL (uniform resource locator; i.e., website address) and drives much of the interactive web. A RESTful query asks for specific things (e.g., "Give me a list of all flights to Hawaii on December 15") and adds features such as security tokens that contain the user's unique identity. Several EHR vendors have already demonstrated that SMART on FHIR apps can be integrated into the clinical environment; at least one large consumer company (Apple Inc.) has announced its intention[42] to use this technology for health care applications. The Office of the National Coordinator for Health Information Technology recently released guidance that APIs are to be a central part of health care technology for the foreseeable future.[43]

Example comparing standard and wiki-format documentation

To illustrate some of the concepts introduced above, we created a series of web pages containing information on a synthetic breast cancer patient, available at https://hemonc.org/wiki/Academic_Medicine_exhibit. In this simplified example, the patient is diagnosed, care is established, and treatment is provided. The standard narrative consists of four disconnected notes of varying lengths. The wiki-based alternative demonstrates how this information can be presented with embedded internal links, tables, and links to outside resources.

Discussion

Despite innovations in documentation in many areas of human endeavor, clinical documentation is trapped in a paradigm shaped primarily by the fee-for-service billing environment. Fortunately, recent legislation enacted by Congress and subsequent activities at the CMS may lay the groundwork for innovative documentation reform.

The 21st Century Cures Act of 2016[44] includes provisions in Title IV meant to improve how EHRs are leveraged for patient care and to address the impact EHRs have had on care delivery. Specifically, the Cures Act establishes a goal for federal agencies to reduce regulatory and administrative burden associated with the use of EHRs (Section 4001(a)(1)(a)). It directs the U.S. Department of Health and Human Services to develop a strategy and recommendations to improve the clinical documentation experience and reduce the reporting burden required of health care providers (Section 4001(b)(3)). Further, it clarifies that a physician may delegate EHR documentation requirements to others on the care team who may not be physicians if the physician signs and verifies the documentation (Section 4001(b)(3)(c)).

In addition, CMS is revisiting its documentation guidelines for E&M services[45] and modifying those requirements to reduce documentation burden.[46] In the calendar year 2019 Revisions to the Physician Fee Schedule, CMS finalized[46] several policy changes meant to address documentation burden. Beginning in 2021, these changes will (1) allow outpatient physician services to be documented on the basis of Medical Decision Making (MDM) or time to determine the appropriate level of E&M visit, and (2) remove redundancy in E&M visit documentation by removing requirements to redocument review of systems, chief complaint,

and family/social history. Meanwhile, CMS has published a draft strategy to reduce administrative burden related to the use of health IT that includes a specific section devoted to clinical documentation.[47] This section largely points to the policy changes finalized by CMS and calls for collaboration among stakeholders to advance documentation "best practices." The strategy also calls for using advanced payment models to wave certain documentation requirements and leveraging health IT to standardize data and processes around ordering services and the related prior authorization processes.

Although these efforts are to be commended—the government is aware of the burden placed on clinicians by documentation requirements—their success in addressing administrative burden is yet unknown. The rigidity of regulatory compliance is deeply ingrained in the workflows of current EHRs. An entirely new approach is needed. If the U.S. health care system continues the transition to payment for outcomes rather than episodes, and to taking care of patients between in-person encounters (e.g., through patient portals), then adopting a wiki format for documentation almost certainly makes the most sense, and a major barrier ("I need one long note per visit to get paid") is breached.

There are other barriers in addition to reimbursement-related issues. To truly galvanize a shift to wiki-based documentation, challenges ranging from the technical to the organizational to the medicolegal need to be addressed. First, the standards development community would need to formalize an effort to ensure the continuity of existing standards in a wiki note, including consideration of how current and future standards might contribute or otherwise be affected. The Federal Health IT Certification Program would then need to adopt specific certification criteria to propagate such functionality across certified EHR technology.[48] Finally, individual health care provider organizations would need to develop standard operating procedures to address editing and override norms.

When and if wikis are adopted, a new etiquette will need to be developed. Using Wikipedia as an example, certain bad behaviors (e.g., "edit warring," name calling, and simple vandalism) do occur.[49] Although the professional and nonanonymous nature of an EHR wiki may discourage much bad behavior, standard expectations will need to emerge for who will do what in the chart and how care team members will reach consensus and handle differences of opinion.

Beyond this challenge, there may be unanticipated consequences of a wiki approach to clinical documentation. For example, when clinical errors occur, it is common practice to perform a root cause analysis that focuses on documentation. Whether such analyses would be made more difficult in a wiki environment is unclear. Relatedly, there may be implications for malpractice lawsuits, although we note that the legal (discoverable) medical record includes a great deal of structured information that is not particularly human readable (e.g., labs, metadata). It is also possible that a record for a patient new to a health care system could appear to be "under construction" for some period of time, similar to Wikipedia pages with many incomplete areas.

We believe that a pilot of a wiki approach would be the best way to learn about its effectiveness. Indeed, the Medicare Prescription Drug, Improvement, and Modernization Act of 2003 authorized such a pilot in Section 941.[50] Whereas the impetus to invest in alternative documentation methods was nascent in 2003, the current impetus is strong. The CMS Innovation Center recently asked for input on "new directions"[51] and is well positioned to investigate the intersection of payment reform and IT-enabled health care delivery reform. Ideally, a pilot of wikis for clinical documentation would (1) create a body of evidence about the effectiveness of such an approach, with a focus on quality outcomes, clinician burnout, interoperability, and fraud, waste, and abuse; (2) lay the groundwork for needed policy reforms to enable such an approach more broadly; and (3) define a starting set of etiquette norms.

As with any innovation, we do not expect a wiki approach to clinical documentation to be adopted immediately. It is likely that transitional steps, such as the problem-oriented documentation being introduced by some EHR vendors, could accelerate a transition. Also, retraining of the workforce and innovations in medical school curricula will be required; the successful program introduced at UCSF School of Medicine[22] could serve as a model on which to build.

Clinical documentation is only a part of what is considered the "complete EHR"[52,53] or the designated record set required by HIPAA,[54] but it is the heart and soul of clinical medicine. Since ancient times, the medical narrative has been used as a means to teach, record, and prompt action.[1] New innovations such as digital images and lab results, electronic prescribing, computerized provider order entry, and clinical decision support have mostly been built as externalities to the documentation process and have contributed to the problem of duplicate data entry.[55] Although the wiki-based documentation approach is not a panacea, the wiki's ability to seamlessly integrate apps and contextual information at the point-of-care offers a new opportunity to achieve better outcomes through the use of health IT, including avoidance of medical errors, reduction of time burdens, and improved communication.

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