

Interoperability of Electronic Health Information and Care of Dialysis Patients in the United States

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Use of electronic health records (EHRs) is standard practice in the United States since adoption in clinics and hospitals was accelerated by passage of the Health Information Technology for Economic and Clinical Health Act (HITECH Act) in 2009. Under the aegis of the federal Office of the National Coordinator for Health Information Technology, clinics and hospitals were required to demonstrate “meaningful use” of EHRs; more recently, rules have focused on interoperability. Interoperability in this context is the ability for EHRs to share clinical information between systems and with patients in a manner that supports clinical decision making, thereby increasing the value of EHRs, particularly for complex medical problems such as end stage kidney disease (ESKD).

Persons with ESKD represent approximately 1% of the population of persons insured through Medicare, but account for 7% of Medicare \$706 billion budget; these figures are growing as the prevalence of ESKD increases (1). Worldwide, ESKD represents a major cause of death and disability (2). The majority of hemodialysis in the United States is provided by approximately 6000 standalone hemodialysis centers that are not colocated with hospitals or multispecialty clinics. About 70% of hemodialysis care is provided by one of several large dialysis organizations, with the remainder provided by smaller hemodialysis networks and independent centers. Hemodialysis centers most commonly use EHRs that are dedicated to documenting hemodialysis care; hemodialysis-specific EHRs also support the unique billing and reporting requirements of hemodialysis care. The large dialysis organizations typically have proprietary EHRs, and smaller networks and independent centers typically use one of several commercially available EHRs. Although there are examples of sharing of clinical information between hemodialysis-specific EHRs and other clinical systems, it is more common for practicing nephrologists to have multiple systems open when seeing patients on dialysis, capturing physician documentation, reviewing details of dialysis care and related facility data, and sometimes additional systems to review information from local hospitals or health information exchanges. As in other medical specialties, it is likely that challenges related to EHRs are a common source of professional dissatisfaction and burnout in nephrology (3). Ideally, information would flow freely between dialysis EHRs and other systems, or one would have a single integrated system.

DaVita is partnering with the large health care software corporation Epic Systems to improve the integration of clinical information for patients with ESKD, but this kind of solution that addresses information exchange between two specific EHRs does not immediately address the broader challenge of exchange between all systems. The EHR landscape will likely remain a mosaic of different vendors, so the challenges of interoperability will remain.

There are clear clinical advantages to being able to share data between EHRs. Because of current siloing of clinical information within separate EHRs, details of recent hemodialysis care may be unavailable to an emergency room physician caring for a patient with sepsis, an updated medication list may be unknown to the nephrologist seeing a dialysis patient after hospitalization for an acute coronary event, and laboratory or imaging studies may be duplicated because the results are unknown to the multiple clinicians seeing a patient with ESKD (4,5). The care of patients on dialysis is especially complex and they experience frequent transitions of care. Persons on dialysis make an average of three emergency department visits and are hospitalized 1.7 times each year; hospital readmission within 30 days occurs in 35.4% of patients with hemodialysis compared with an average of 15.4% for the Medicare population without kidney disease (1). Much of this difference may be driven by disease-specific factors, but inadequate information exchange at transitions of care may increase duplicate testing and patient care costs, and contribute to readmission rates (6,7).

In the near term, there are a variety of ways that exchange of clinical information may be achieved for patients with ESKD. Hemodialysis-specific EHRs typically aggregate and report structured summary data to CROWNWeb, the national ESKD patient registry and quality reporting system. In some parts of the country, participating dialysis centers share structured reports with regional health information exchanges, centralized networks that collect and share a limited set of standardized documents. These standardized documents were required as part of the Meaningful Use program and include such things as transition of care summaries, diagnostic imaging reports, and referral notes. Health information exchanges represent an achievable common denominator for interoperability, but are limited in that clinical information shared by an outside system must be manually abstracted for input

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into a host system. Commercial EHRs marketed in the United States are able to exchange these structured documents. Another type of interoperability involves connecting peer systems with an interface, allowing exchange of predefined clinical data between systems. This peer-to-peer connection requires custom-built interfaces between systems, with detailed programming that defines how each type of data would flow between systems. Many health care organizations have custom interfaces between EHRs and dedicated laboratory or radiology information systems. Such custom interfaces are expensive to build and maintain. Furthermore, connecting pairs of EHRs is not scalable; individual dialysis center EHRs and individual hospital or clinic EHRs would need to build multiple peer-to-peer custom interfaces to achieve interoperability for populations of patients on hemodialysis. The future of interoperability may lie in using emerging standards for sharing clinical data more easily between software applications, both large EHR systems and mobile devices. One such standard is the Fast Healthcare Interoperability Resource, commonly referred to as FHIR (“fire”). This emerging standard defines how EHR systems expose data to be queried, structured, and securely transmitted, in a manner analogous to how one uses applications to make airline reservations or check bank balances. Similar to a custom peer-to-peer interface, an interface standard would allow exchange of granular clinical data such as vital signs, laboratory data, or medications while maintaining the semantic integrity of the information, instead of limiting exchange to structured documents like some health information exchanges. Unlike custom peer-to-peer interfaces, however, interface standards would provide rules that would allow any authorized software application to exchange information with a clinical database. Importantly, industry-wide acceptance of interface standards would substantially reduce the challenges of maintaining custom interfaces in the face of inevitable software updates.

A number of important challenges need to be overcome to achieve more seamless interoperability between EHR systems, including establishing a system for unique identification of patients, health care providers, and health care organizations; broad adoption of existing standards for reporting clinical data and descriptions of hemodialysis procedures and standards for secure data transmission between systems; and governmental policy and public-private partnerships that encourage interoperability (8). Some of these technical hurdles remain to be solved, but it will be helpful for professional organizations and governmental entities to continue to push for seamless interoperability in the interest of the quality and safety of patient care.

Government regulation and financial incentives have worked to advance EHR adoption here and in other countries; crucially, government incentives and public-private partnerships have helped promote interoperability (9). In the United Kingdom, the National Health Service reimbursed general practitioners for costs of EHR hardware, software, and maintenance of EHRs, provided they chose EHRs that were certified to be able to exchange clinical information using nationally adopted standards. These financial incentives worked: important patient information flowed during transfer of care, reducing data entry burdens

for general practices (9). Because the ecosystem of health care organizations in the United States is so diverse, ranging from large, multihospital systems to single provider clinics, and from large dialysis organizations to independent community-based dialysis centers, government regulations regarding interoperability will continue to be very broad for the foreseeable future. Our national goal should be to democratize interoperability, making widely available, simple and inexpensive tools that require little or no technical support and are as accessible to small clinics and independent dialysis centers as large medical centers and large dialysis organizations. At a minimum, it should be possible for hemodialysis facilities to query hospital EHRs to obtain recent treatment records in the form of standardized documents, including discharge summaries, medication lists, reports of diagnostic studies, and laboratory data. Similarly, hospitals should be able to query hemodialysis facility EHRs to obtain analogous clinical data. In the future, standards-enabled web and mobile applications promise to connect EHRs and even to help engage patients in clinical care. What is needed now are incentives and direction to overcome the siloing of information faced by patients with ESKD and the clinical teams who care for them. Incentives for interoperability must involve EHR vendors, payors (federal and private), and clinicians/health care organizations. The ability to exchange clinical data with a variety of peer systems using interoperability standards should be a required feature of the EHRs certified by the Office of the National Coordinator for Health Information Technology. Because of the complexity of patients with ESKD and the cost for their care, we all stand to benefit when patients and physicians can focus on clinical care, and the clinical information needed—already in electronic form—comes to them in the background.

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Disclosures

Dr. Payne and Dr. Sutton have nothing to disclose.

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