



# A Family Medicine Health Technology Strategy for Achieving the Triple Aim for US Health Care

Robert L. Phillips Jr, MD, MSPH; Andrew W. Bazemore, MD, MPH; Jennifer E. DeVoe, MD, DPhil; Thomas J. Weida, MD; Alex H. Krist, MD, MPH; Michael F. Dulin, MD, PhD; Frances E. Biagioli, MD

**BACKGROUND AND OBJECTIVES:** Health information technology (health IT) and health technology, more broadly, offer tremendous promise for connecting, synthesizing, and sharing information critical to improving health care delivery, reducing health system costs, and achieving personal and community health. While efforts to spur adoption of electronic health records (EHRs) among US practices and hospitals have been highly successful, aspirations for effective data exchanges and translation of data into measurable improvements in health outcomes remain largely unrealized. There are shining examples of health enhancement through new technologies, and the discipline of family medicine is well poised to take advantage of these innovations to improve patient and population health. The Future of Family Medicine led to important family medicine health IT initiatives over the past decade. For example, the American Academy of Family Physicians (AAFP) Center for Health Information Technology and the Robert Graham Center provided important leadership for informing health IT policy and standard-setting, such as the Centers for Medicare and Medicaid Services EHR incentives programs (often referred to as “meaningful use”). As we move forward, there is a need for a new and more comprehensive family medicine strategy for technology. To inform the Family Medicine for America’s Health (FMAHealth) initiative, this paper explores strategies and tactics that family medicine could pursue to improve the utility of technology for primary care and to help primary care become a leader in rapid development, testing, and implementation of new technologies. These strategies were also designed with a broader stakeholder audience in mind, intending to reach beyond the work being done by FMAHealth. Specific suggestions include: a shared primary care health IT center, meaningful primary care quality measures and capacity to assess/report them, increased primary care technology research, a national family medicine registry, enhancement of family physicians’ technology leadership, and championing patient-centered technology functionality.

(Fam Med 2015;47(8):628-35.)

Over the last 2 decades, the US health care system has experienced an explosion in health information technology (health IT) and other technological innovations designed to support health. This paper explores primary care health IT deployment to date, its shortcomings in support of the nation’s Triple Aim, and offers strategies and tactics that family medicine could pursue to improve the utility of health IT for primary care through Family Medicine for America’s Health (FMAHealth) and other initiatives. Beyond health IT, this paper then discusses the broader options for family medicine in addressing the need for new technologies to ensure that these serve primary care physicians and their patients well.

## Health IT

An overwhelming majority of US primary care practices and hospitals now use electronic health records (EHRs), and there is evidence of increasing consolidation and focus on interoperability.<sup>1-3</sup> However, policy

---

From The American Board of Family Medicine, Lexington, KY (Dr Phillips); The Robert Graham Center, American Academy of Family Physicians, Washington, DC (Dr Bazemore); Oregon Health & Science University (Drs DeVoe and Biagioli) and OCHIN, Inc, Portland, OR (Dr DeVoe); College of Community Health Sciences, University of Alabama (Dr Weida); Virginia Commonwealth University (Dr Krist); and Carolinas HealthCare System (Dr Dulin).

makers remain concerned that we have failed to extend the availability of EHRs from a few large institutions to smaller clinics and rural practices—the practices where most Americans receive their health care.<sup>4,5</sup> The current challenges around EHRs are quite different from those faced by family medicine when the FFM initiative was launched, but even a decade ago, FFM priorities spoke to the need for EHRs with the capacity for clinical decision support and for sharing data.<sup>6</sup>

Much of the core functionality of current EHRs was driven by payment systems designed during the era of paper-based medical records. EHRs effectively collect the data needed to substantiate payments; however, most EHRs fail to capture clinical data in the best format to truly measure and then improve care delivery. Thus, clinicians are inundated with EHR data but do not have effective tools to aggregate, translate, and assimilate data into useful formats for informing and improving patient or population health. Physicians have also experienced increased documentation burdens with new EHR implementations, and EHRs have reduced physician efficiency overall.<sup>7-10</sup> The recent JASON (an independent group of scientists who advise the US government on matters of science and technology)

report concluded that while EHRs do a fair job of maintaining medical history and managing electronic prescribing, they have created new work for physicians that distract from patient engagement, and they have largely failed to deliver on sharing data, providing decision support during patient care, or supporting population health monitoring or management (See Table 1).<sup>11</sup> There is also some evidence that EHRs do not lead to improved care quality;<sup>12</sup> further, EHRs and other health IT tools have only rarely realized their potential to advance population health and other efforts to improve community health. In 2013, RAND, which had hailed the cost-saving potential of EHRs, pulled back from that optimism describing “shortcomings in the design, implementation, and use of health IT in the United States.”<sup>13</sup>

To address some of these shortcomings, the US Department of Health and Human Services (HHS) has tried to standardize essential EHR functions under the umbrella of the certification program of the Office of the National Coordinator (ONC) for health IT. ONC’s certification program requires practices that participate in the Centers for Medicare and Medicaid Services (CMS) EHR incentive programs to purchase and implement “Certified EHR Technology.” While this added a

significant financial burden for many practices wanting to upgrade (eg, from “2011 Edition” certified products to “2014 Edition” certified products), it is unclear to what extent these upgrades will improve primary care practice and patient health.

In general, primary care has been unable to sufficiently influence health IT policies and standards to better support important primary care functions despite compelling arguments and recommendations.<sup>14,15</sup> Several of the FFM recommendations regarding information systems in health care have not been met;<sup>6</sup> however, some progress has been made. For example, the American Academy of Family Physicians (AAFP) Center for Health Information Technology was a response to the FFM call for IT advocacy. The Robert Graham Center received federal funding to help identify options for harmonizing primary care data standards.<sup>14</sup> The North American Primary Care Research Group created a health IT committee in response to FFM, which published important statements about how to improve health IT functionality to support primary care practice and research (Table 2).<sup>15</sup> Some family physicians have been using innovative health IT tools to deliver better care to populations and to partner with patients in doing so.<sup>16-19</sup> More recently,

**Table 1: Themes From the JASON Study<sup>1</sup>**

• EHRs and health information exchanges (HIEs) are currently woefully inadequate in what they provide to health care professionals.
• Data collection interrupts workflow and needs to be made less intrusive.
• The level of interoperability set forth through the CMS Meaningful Use criteria, as a result of the HITECH Act, is too low to drive meaningful progress.
• Innovation in health care appears to be frozen by a deluge of overly ambitious, insufficiently practical, and often conflicting advice.
• Vendor proprietary issues are a barrier to interoperability and innovation.
• There are a plethora of standards and national deployment organizations but none that might be regarded as a consensus for adoption.
• A HIE infrastructure that will support research has not yet been identified, and current efforts toward this infrastructure may have the opposite effect.
• EHRs should not be things that one buys but rather things that evolve through cultural change aided by technology.
• It is desirable to have a continuous rather than episodic personal health record.
• At present, HIEs are largely seen as replacements for fax machines.

**Table 2: Critical Primary Care Needs of Electronic Health Records<sup>2</sup>**

1. Enhancing the extraction, interpretation, and prioritization of critical health information for individual patients and a clinician's patient panel.
2. Advancing information exchange to coordinate care across clinicians and settings.
3. Greater patient engagement.
4. Population-management tools to deliver care.
5. Reduction in documentation burden.
6. Better integration of care across settings.

the American Board of Family Medicine (ABFM) launched the Trial of Aggregate Data Extraction for Maintenance of Certification and Raising Quality (TRADEMaRQ) study with support from the US Agency for Healthcare Research and Quality (Grant 1R21HS022583-01A1), which creates a receptor site for the exchange of quality metrics based on EHR data from family physicians. The ABFM will soon launch the Data Abstraction Intelligence Quality Engine for Research and Improvement (DAIQUERI), an active data extraction to help pull data from family physician EHRs and turn it into clinically actionable information for practices and a means to exchange data for quality improvement. TRADEMaRQ and DAIQUERI will form a registry for the specialty, which promises to help overcome some of the shortcomings of current EHR technology.

Building on foundational FFM efforts, family medicine is poised to provide leadership to guide the design and implementation of health IT. This is an opportune time to again think strategically about an organized approach to family medicine's efforts around health IT advocacy and evolution. While EHRs and other information systems dominate the technology landscape for many physicians, there are a number of other technological innovations that have come onto the scene and have great potential to improve primary care practice and patient health.

### Technology Beyond Traditional Health IT

Patients want their health information, better access to their care team, and simple everyday tools to manage their health and well-being.<sup>20</sup> This includes electronic or telemedicine consultations (e-visits or video visits). Some practices and health systems are experimenting with different patient engagement technologies to support these modalities, for example, through offering urgent video visits;<sup>21</sup> however, most payment and practice models do not yet support these innovations, and many are unsure of the medical-legal ramifications of this form of care.<sup>3</sup> Some health systems, like Partners Healthcare, are plunging ahead with chronic care self-monitoring technology, electronic primary care visits, text messaging programs, and patient EHR portals.<sup>22</sup>

In the past, health-conscious patients brought their family physicians spreadsheets of their blood sugars, exercise, and meals, often drawing their own insights about which foods or activities correlated with better blood sugar levels. These same patients, and many others, are now wearing devices or using smart phone apps to do this work routinely. Patients are also increasingly wearing devices that capture their health habits and offer them feedback intended to influence their behavior. Data captured by these devices also have potential utility for improving care quality and population health, and technological enhancements that can integrate additional health and disease data are on the horizon.

Family physicians must play a leadership role in shaping how these data can be used most effectively. Further, translation of these data into information that can inform physician-patient interactions, virtually and in person, is an exciting opportunity that needs shepherding by family medicine to meet its potential.

Physicians want technology that can improve the delivery and quality of care, reduce practice and health care costs, manage populations of patients, and make practicing medicine easier.<sup>23-25</sup> Comprehensive, broad-scope family medicine will also benefit from technology. Many family physicians are already using ultrasound to do what used to require other imaging, particularly for musculoskeletal diagnoses and procedures. There will be increasing capacity to move what are currently hospital- or subspecialty-based technologies out to the family medicine clinic in the near future, in much the same way that many tests that used to require specialized laboratories are now being done in primary care clinics at the point of care.

In addition to technologies that enhance our clinical toolbox, communication technology has the capacity to make us more available to patients virtually, increasing access and continuity. For example, Richard Roberts, MD, past president of the World Organization of Family Physicians, rounded on patients in the hospital in Wisconsin from halfway around the world using web-based communication services. Arkansas crafted Medicaid payment to support having a primary care physician in

the room when complex prenatal patients are electronically meeting with maternal-fetal medicine specialists.<sup>26</sup> New Mexico uses Telehealth innovations to engage hepatologists virtually in primary care visits for patients with Hepatitis C in rural areas.<sup>27</sup> Having both physicians “in the room” (one physically, the other virtually) allows the patient to benefit from specialty services, allows the primary care physician to translate the plan, increases the competency of the primary care physician, and allows the patient to have an advocate who knows them, their health, and their values in order to help negotiate the health care plan. Web-based video is also becoming a popular place for patient and professional education content.<sup>28</sup> This passive technology is already revolutionizing how we can instruct patients, but the future holds great promise for active technology that guides, coaches, and measures how patients are following our guidance.

In conclusion, some of family medicine’s early health IT efforts by individual practices, research groups, and national family medicine organizations are overlapping but have not yet been fully integrated. To continue progress toward achieving the FFM goals and to accelerate future progress, it is timely to consider how family medicine could more effectively organize resources to form a united front for improving health IT and other technologies for the specialty. Improved patient care, more robust population health, and reduced cost of care can all be augmented by family medicine’s leadership to improve and enhance a broad array of existing and new technologies. We need to capitalize on our collective strengths.

### Opportunities

As a medical specialty with significant depth and breadth of experiences and expertise, family medicine is perfectly positioned to lead and support innovative initiatives in primary care technology. This section highlights a few of the promising new and emerging opportunities for the

FMAHealth Technology Tactic Team to consider as priorities.

### Health IT Tools

In addition to leading efforts to ensure that EHRs can be used to their full potential, family physicians have the expertise to partner with patients to identify and rigorously test other health IT innovations that can augment patient care and improve outcomes through patient, community, and health-team engagement. Some examples include: tools for decision-making, information and treatment management, lifestyle management; secure patient and care team communication tools; online health communities and social support; and tools that do quality and safety monitoring and reporting. These technologies are not intended to replace the patient-provider relationship but to extend it and improve health and health care. For example, family physicians can determine whether a relationship-extension tool expands upon limited EHR functionality, can be easily accessed by a patient or provider, and can provide an effective mechanism for starting a virtual conversation to personalize health care. Recently, four primary care organizations summarized the imperative for this important work:

Primary care needs EHRs to move beyond documentation to interpreting and tracking information over time, as well as patient-partnering activities, support for team-based care, population-management tools that deliver care, and reduced documentation burden.<sup>15</sup>

### Big Data

The enormous volume of data captured by EHRs, paired with growing capacity for data linkage and exchange, creates “big data” opportunities for measuring outcomes and informing efforts to improve patient and population health. This huge bolus of EHR data must be connected, normalized and analyzed appropriately, in order to best

inform practice-based and community-based solutions and other initiatives to improve personal and population health.<sup>29</sup> Family physicians can play a crucial role in leading primary care and community big data efforts and have already recognized that for both personal and population health, it will be essential that data from EHRs are aggregated with other data sources (eg, health insurance claims, public health surveillance systems, neighborhood-level health indicators).<sup>30</sup> Further, integrated big data systems must also collect information directly from patients about their health behaviors, community resource utilization, social networks, and other social determinants of health. Social determinant data can also be collected ecologically from existing federal and state sources, which add additional information about neighborhood cohesion, as well as health and crime risks.

Although many of these data elements already exist, there are few examples where they are sufficiently integrated to inform practice, research, or policy. There is a need for the development of new methods to fully capitalize on the use and integration of multiple innovative data sources to reduce disparities and improve health equity. This was a specific recommendation of the Institute of Medicine consensus study “Primary Care and Public Health: Exploring Integration to Improve Population Health.”<sup>31</sup> These big data opportunities will also help us better understand how to risk stratify our patients based on personal and neighborhood measures.

### Primary Care Data Models

Primary care is the largest platform for clinical services in the US. Family medicine must develop strategies to capture and organize data to meet primary care needs while harmonizing a unique primary care data model with the rest of the clinical community. The immediate past chair of the National Committee on Vital and Health Statistics called

for family medicine to “establish a proper data model to unite and guide the discovery of family medicine and primary care.”<sup>32</sup> The leading primary care data model is the International Classification of Primary Care (ICPC), already widely used in several European countries.<sup>33</sup> It is a recognized classification in the United States. Since ICPC is mapped to other international standards, it offers an alternative to migrating from ICD-9 to ICD-10 and then ICD-11 by using ICPC mappings to these other classification systems. ICPC is an advanced classification system that also provides clinical decision support; for example, ICPC allows understanding of which breast symptoms suggest breast cancer and the development of conditions comorbid with diabetes over time.<sup>34,35</sup> Getting EHR vendors to offer a primary care data model will require collective family medicine leadership and advocacy.

### Measures

There are currently more than 80 electronic clinical quality measures applicable to primary care that have been included in CMS incentive programs. Most of these measures are disease specific or process oriented and are not derived from important research about measuring what matters most in primary care.<sup>36-40</sup> Assessments of family medicine’s effectiveness may be misguided or erroneous if the measures used to assess practice or outcomes neglect the very features that produce value. Because these measures become embedded in the technology we use, guide our clinical decisions, and will increasingly drive payment, it is essential that we see measurement as a priority of technology strategy.

### Practice Technologies

Family medicine organizations should be assessing innovative and new models of care, with an eye for how technology can enhance access, continuity, and comprehensiveness. Kaiser’s mid-Atlantic region offices have conducted more than 4,200

member visits via telehealth since 2013.<sup>40</sup> We could learn from groups like them about the most effective means of delivering quality, technology-enabled care. There may also be opportunities to partner with technology companies to retrofit or design new diagnostic tools and tests for the outpatient setting. Partnering with our patients, family medicine is well-positioned to embrace practice technologies that improve our practices and our patients’ health.

### Patient Technologies

Partnering with patients should also include discussions about how to better incorporate and use technologies available to patients to meet their needs. Which online videos are the most helpful? What are the best smart phone apps for monitoring and improving health? What kind of online peer-learning experiences are engaging or motivating? Have patients in our practices tried wearable devices, and are they interested in sharing the data they sync with their computing devices? How can family doctors best partner with patients to identify, improve, test, and adopt technologies that are most constructive and effective?

### Recommendations

In early documents that laid the groundwork for the FMAHealth initiative, the Steering Committee outlined four core tactics for consideration and further development by the FMAHealth Technology Core Team (Table 3). This list includes the critical priority of creating a shared center for primary care health IT with governance similar to the *Annals of Family Medicine* journal, through which many primary care organizations and supporters would have shared ownership, funding, opportunity, and responsibility for the strategy. A collective center for health IT is needed to provide leadership, strategy and research, and to develop a shared vision for a health information strategy with common goals of improving health,

promoting health equity, and achieving the Triple Aim.

In addition to the needs of primary care health IT outlined by Krist et al (Table 2) and the four initial FMAHealth core tactics (Table 3), we propose some specific recommendations for consideration by the FMAHealth Technology Tactic Team.<sup>15</sup> Because some of these suggestions fall under the existing FMAHealth tactics and others build on these tactics, we identified other family medicine organizations that may potentially want to develop plans for implementing these recommendations:

(1) Develop and implement strategies for creating datasets and data analysis techniques that integrate clinical data, care delivery data, population health data, socioeconomic data, and quality measurement data. These strategies should be driven by the fundamental information needs of family physicians and the teams in which they work (AAFP, ACOFP, ABFM, ADFM, AFMRD, NAPCRG, STFM).

(2) Develop a strategic group to define, develop, and test measures for desired capabilities of primary care practices and to seek endorsement and adoption of these measures (AAFP, ABFM, ACOFP, NAPCRG).

(3) Promote practice-, physician-, and patient-centered research to evaluate the health IT design and implementation needs of primary care (AAFP, ACOFP, ABFM, NAPCRG).

(4) Develop clinical registries that can translate data into clinically useful information and facilitate exchange or reporting (ABFM, AAFP).

(5) Develop population health tools that use patient, population, and community data within geospatial tools (ABFM, AAFP, ACOFP).

(6) Create a strategy for the development and widespread adoption of data models that better serve primary care (AAFP, ACOFP, ABFM, NAPCRG).

(7) Create fellowships to develop health IT leaders with specific

**Table 3: Family Medicine for America's Health Core Tactics**

Tactic	Sample Tasks
Launch the newly charged and expanded Center for Primary Care Health IT.	<ul style="list-style-type: none"> <li>• Launch newly charged entity: Center for Primary Care Health IT, or other name as agreed upon.</li> <li>• Pursue funding. Collaborate with the Graham Center.</li> <li>• Work with counterpart organizations in other primary care professions (eg, AAP, ACP) to increase impact through collaboration.</li> </ul>
Build improvements into existing EHR platforms, making it easier for physicians to practice great primary care.	<ul style="list-style-type: none"> <li>• Define needs of high-functioning EHR on two levels:  <b>Patient needs:</b> eg, decision support, patient access to data, patient-entered data, individual care plans, and quality metrics.  <b>Population needs:</b> eg, risk stratification, disease registries, reporting requirements, and analytics.</li> <li>• Identify EHR platforms with highest market share in family practices and work with them to close gap between needs definition and current state.</li> <li>• Explore opportunities to foster greater interoperability between systems.</li> <li>• Create and deploy ongoing feedback mechanisms to promote usability/flexibility with vendors over time and evaluate platforms.</li> </ul>
Link the use of new and emerging technologies to facilitating practice—strengthening relationships between patients and care team while enabling care team to practice in a more scalable way.	<ul style="list-style-type: none"> <li>• Leverage capabilities and expand reach by collaborating with an organization like Consumer Reports to continually evaluate emerging technologies; work with research function to determine usefulness.</li> <li>• Assess potentially expanded role for technologies to deliver more patient centric care, including in-office ultrasound equipment and applied genomics.</li> <li>• Provide pathways for family physicians to integrate.</li> </ul>
Assess potentially expanded role of applied genomics in primary care and provide a pathway for family physicians to integrate this technology with practice.	<ul style="list-style-type: none"> <li>• Develop actions and timing based on what is learned about applied genomics and its implications for primary care.</li> </ul>

EHR—Electronic Health Record, ACP—American College of Physicians, APA—American Pediatric Association

expertise in primary care technology needs (STFM, ADFM, AFMRD).

(8) Develop curriculum and educational tools to address the key capabilities for family medicine practices that utilize health IT and other health technologies; advocate for increased health IT and health technology training in medical school and residency (STFM, ABFM, AAFP, ACOFP).

(9) Support learning collaboratives and laboratories for testing new technologies and disseminating best practices (like test farms of the Cooperative Extension Program) (AAFP, ACOFP, STFM, NAPCRG).

(10) Develop relationships with Health Information Exchanges, Regional Extension Centers, Health Center-Controlled Networks, and Primary Care Extension Services to support better data and technology use (AAFP and its chapters).

(11) Work with patient and consumer organizations to identify promising patient- and family-centered technologies, and collaborate to translate these into technology solutions; encourage practices to do the same locally (AAFP, ACOFP).

(12) Partner with technology companies to retrofit or develop technology solutions that improve access, continuity, and comprehensiveness (AAFP and its chapters).

(AAFP—American Academy of Family Physicians, ABFM—American Board of Family Medicine, ACOFP—American College of Osteopathic Family Physicians, ADFM—Association of Departments of Family Medicine, AFMRD—Association of Family Medicine Residency Directors, NAPCRG—North American Primary Care Research Group, STFM—Society of Teachers of Family Medicine).

## Conclusions

Family physicians provide more outpatient visits than any other medical specialty in the United States and are leaders in the adoption and use of health IT. Collectively, family medicine is entrusted with clinical information for more than 20% of all outpatient care; thus, our discipline is uniquely positioned to play a leadership role in articulating how best to improve health IT to better serve patients and create a big data strategy for improving the nation's health.<sup>41</sup> Currently, the health IT that is in use does not capture or manage clinical information in ways that support the key functions of primary care (eg, patients' concerns, complexity, continuity, coordination, episode management, behavior change). When practices successfully implement primary care-friendly systems, these are sometimes uprooted to make way for

hospital-preferred systems despite the fact that only one in 15 patients who go to primary care touch a hospital.<sup>41</sup> Beyond health IT, the specialty has barely scratched the surface in exploring how technology can enhance the best features of primary care. Family medicine has several opportunities to take a lead in shaping new health technologies to ensure that technology is better used in the service of better health, better health care, and lower costs.

**ACKNOWLEDGMENTS:** Dr Phillips declares that he has received grant support from the Agency for Healthcare Research and Quality for testing physician quality measure exchange and quality improvement (1R21HS022583-01A1). Dr Biagioli declares that she received grant support for the integration of HIT into medical education: National Cancer Institute (1R25CA158571-01A1) PI: Frances Biagioli, MD. Dr DeVoe declares that she received grant support for the creation of the ADVANCE Clinical Data Research Network from the Patient-Centered Outcomes Research Institute. The other authors have no conflicts of interest to declare.

**CORRESPONDING AUTHOR:** Address correspondence to Dr Phillips, The American Board of Family Medicine, 1648 McGrathiana Parkway, Suite 550, Lexington, KY 40511. 202-494-0512. bphillips@theabfm.org.

## References

- Hsiao CJ, Jha AK, King J, Patel V, Furukawa MF, Mostashari F. Office-based physicians are responding to incentives and assistance by adopting and using electronic health records. *Health Aff (Millwood)* 2013 Aug;32(8):1470-7.
- HHS Press Office. Doctors and hospitals' use of health IT more than doubles since 2012. More than half of America's doctors have adopted electronic health records. 2013. <http://www.hhs.gov/news/press/2013pres/05/20130522a.html>. Accessed January 4, 2014.
- Marbury D. Consolidation, physician demand drive change. *Med Econ* 2013;90(20):46.
- Blumenthal D, Tavenner M. The "meaningful use" regulation for electronic health records. *N Engl J Med* 2010;363(6):501-4.
- Xierali IM, Hsiao C-J, Puffer JC, et al. The rise of electronic health record adoption among family physicians. *Ann Fam Med* 2013 Jan-Feb;11(1):14-9.
- Future of Family Medicine Project Leadership Committee. The Future of Family Medicine: a collaborative project of the family medicine community. *Ann Fam Med* 2004;2(suppl 1):S3-S32.
- Makam AN, Lanham HJ, Batchelor K, et al. Use and satisfaction with key functions of a common commercial electronic health record: a survey of primary care providers. *BMC Med Inform Decis Mak* 2013;13:86.
- Howard J, Clark EC, Friedman A, et al. Electronic health record impact on work burden in small, unaffiliated, community-based primary care practices. *J Gen Intern Med* 2013 Jan;28(1):107-13.
- Clarke MA, Steege LM, Moore JL, Koopman RJ, Belden JL, Kim MS. Determining primary care physician information needs to inform ambulatory visit note display. *Appl Clin Inform* 2014;5(1):169-90.
- Zhou Y, Ancker JS, Upadhye M, et al. The impact of interoperability of electronic health records on ambulatory physician practices: a discrete-event simulation study. *Inform Prim Care* 2013;21(1):21-9.
- JASON: The MITRE Corporation. A robust health data infrastructure. Rockville, MD: Agency for Healthcare Research and Quality, 2014.
- Crosson JC, Ohman-Strickland PA, Hahn KA, et al. Electronic medical records and diabetes quality of care: results from a sample of family medicine practices. *Ann Fam Med* 2007;5(3):209-15.
- Kellermann AL, Jones SS. What it will take to achieve the as-yet-unfulfilled promises of health information technology. *Health Aff* 2013;32(1):63-8.
- Robert Graham Center. Harmonizing primary care clinical classification and data standards. In: Phillips R Jr, Klinkman M, Green L, eds. Washington, DC: American Academy of Family Physicians, 2007.
- Krist AH, Beasley JW, Crosson JC, et al. Electronic health record functionality needed to better support primary care. *J Am Med Inform Assoc* 2014 Sep-Oct;21(5):764-71.
- Hatch B, Angier H, Marino M, et al. Using electronic health records to conduct children's health insurance surveillance. *Pediatrics* 2013;132(6):e1584-1591.
- Dulin MF, Ludden TM, Tapp H, et al. Using geographic information systems (GIS) to understand a community's primary care needs. *J Am Board Fam Med* 2010;23(1):13-21.
- Heintzman J, Marino M, Hoopes M, et al. Using electronic health record data to evaluate preventive service utilization among uninsured safety net patients. *Prev Med* 2014;67:306-10.
- Angier H, Gold R, Crawford C, et al. Linkage methods for connecting children with parents in electronic health record and state public health insurance data. *Matern Child Health J* 2014 Nov;18(9):2025-33.
- Tang PC, Lansky D. The missing link: bridging the patient-provider health information gap. *Health Aff* 2005;24(5):1290-5.
- Smith J, Holder H, Edwards N, et al. Securing the future of general practice: new models of primary care. Nuffield Trust Research Report. 2013. [http://www.nuffieldtrust.org.uk/sites/files/nuffield/130718\\_securing\\_the\\_future\\_of\\_general\\_practice\\_full\\_report\\_0.pdf](http://www.nuffieldtrust.org.uk/sites/files/nuffield/130718_securing_the_future_of_general_practice_full_report_0.pdf).
- Partners Healthcare. Applying technology to patient care. 2015. <http://www.partners.org/Innovation-And-Leadership/Technology/Default.aspx>, 2015.
- Terry AL, Brown JB, Bestard Denomme L, Thind A, Stewart M. Perspectives on electronic medical record implementation after two years of use in primary health care practice. *J Am Board Fam Med* 2012;25(4):522-7.
- Goetz Goldberg D, Kuzel AJ, Feng LB, DeShazo JP, Love LE. EHRs in primary care practices: benefits, challenges, and successful strategies. *Am J Manage Care* 2012 Feb;18(2):e48-54.
- Friedberg M, Chen P, Van Busum K, et al. Factors affecting physician professional satisfaction and their implications for patient care, health systems, and health policy. RAND Corporation. December 1, 2014. [http://www.rand.org/pubs/research\\_reports/RR439.html](http://www.rand.org/pubs/research_reports/RR439.html).
- Magann EF, Bronstein J, McKelvey SS, Wendel P, Smith DM, Lowery CL. Evolving trends in maternal fetal medicine referrals in a rural state using telemedicine. *Arch Gynecol Obstet* 2012;286(6):1383-92. doi: 10.1007/s00404-00012-02465-00405.
- Arora S, Thornton K, Jenkusky SM, Parish B, Scaletti JV. Project ECHO: linking university specialists with rural and prison-based clinicians to improve care for people with chronic hepatitis C in New Mexico. *Public Health Rep* 2007;122(Suppl 2):74-7.
- Emory University School of Medicine. YouTube for patient and professional education. 2015. [http://med.emory.edu/pa/about\\_us/mobile\\_medicine/youtube.html](http://med.emory.edu/pa/about_us/mobile_medicine/youtube.html).
- Devoe JE, Sears A. The OCHIN community information network: bringing together community health centers, information technology, and data to support a patient-centered medical village. *J Am Board Fam Med* 2013;26(3):271-8.
- Bazemore AW, Cottrell EK, Gold R, et al. "Community Vital Signs": incorporating geocoded social determinants into electronic records to promote patient and population health. <http://jamia.oxfordjournals.org/content/jaminfo/early/2015/07/10/jamia.ocv088.full.pdf>.
- Institute of Medicine. Primary care and public health: exploring integration to improve population health. Washington, DC: The National Academies Press, 2012.
- Green LA. Who will establish a proper data model for family medicine and primary care? *J Am Board Fam Med* 2014 Nov 1;27(6):736-7.
- Soler J-K, Okkes I, Wood M, Lamberts H. The coming of age of ICPC: celebrating the 21st birthday of the International Classification of Primary Care. *Fam Pract* 2008;25(4):312-7.
- Luijckx H, Schermer T, Bor H, et al. Prevalence and incidence density rates of chronic comorbidity in type 2 diabetes patients: an exploratory cohort study. *BMC Medicine* 2012;10(1):128.
- Eberl MM, Phillips RL, Lamberts H, Okkes I, Mahoney MC. Characterizing breast symptoms in family practice. *Ann Fam Med* 2008;6(6):528-33.
- Safran DG, Kosinski M, Tarlov AR, et al. The Primary Care Assessment Survey: tests of data quality and measurement performance. *Med Care* 1998 May;36(5):728-39.

37. Flocke SA, Stange KC, Zyzanski SJ. The association of attributes of primary care with the delivery of clinical preventive services. *Med Care* 1998;36(8):AS21-AS30.
38. Stange K, Nutting P, Miller W, et al. Defining and measuring the patient-centered medical home. *J Gen Intern Med* 2010;25(6):601-12.
39. Tahir D. Innovations: Kaiser tests video visits to cut waits. *Modern Healthcare* 2015; Feb 21.
40. National Center for Health Statistics. National Ambulatory Medical Care Survey: 2010 Summary Tables. 2012. [http://www.cdc.gov/nchs/ahcd/web\\_tables.htm#2011](http://www.cdc.gov/nchs/ahcd/web_tables.htm#2011). Accessed December 14, 2014.
41. Green LA, Fryer GE, Yawn BP, Lanier D, Dovey SM. The ecology of medical care revisited. *N Engl J Med* 2001;344(26):2021-5.