It’s Time to Bring Human Factors to Primary Care Policy and Practice

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Richard J. Holden, PH.D., Erkin Ötleş, M.S.
Lee A. Green, M.D., Linsey M. Steege, PH.D.
Tosha B. Wetterneck, M.D, M.S.
Why bother discussing this?

• “...EHR products have not had a measurable effect on the very goals to which meaningful use aspires.”
• “...the challenge of ensuring that meaningful use actually leads to meaningful benefits...improvements in safety and quality of care, remains a serious concern.”

Classen DC, Bates DW. Finding the Meaning in Meaningful Use. NEJM 2011;365:855-858
A decade ago, a primary care physician I admired seemed to come undone. His efficiency had derived not from rushing between patients but from knowing them so well that his charting was effortless and fast. But suddenly he became distracted, losing his grip on the details of his patients’ lives.

...he became distracted, losing his grip on the details of his patients’ lives.

…the EHR has been a disaster for the clinical user, in large part because the billing/compliance function has dominated.  
…Only in health care, it seems, could we find a way to “automate” that ended up adding staff and costs.

Primary Care is in Trouble

• Older, more complex patients
• Physicians (and other clinicians) reducing scope of practice and/or retiring early
• Interventions intended to help have been largely ineffectual and there are unanticipated harms from
  • EHRs
  • PCMH
• Much of this is due to the inappropriate use of technology
  • Increased interruptions
  • Loss of flow
  • Shunting physician attention to clerical tasks
  • Poor communication strategies
    • The goal is NOT to document!
“Houston, we have a problem...”

• The current state of EHR use has resulted in...
  • Inefficient data entry
  • Decreased quality of face to face patient interaction
  • More difficult, less fulfilling work
  • Degradation of the quality of clinical notes
  • Decreased workforce satisfaction
    • More errors, higher costs, more lawsuits, burnout

http://www.rand.org/content/dam/rand/pubs/research_reports/RR400/RR439/RAND_RR439.pdf
Coleman M, Dexter D, Nankivil N. Factors Affecting Physician Satisfaction and Wisconsin Medical Society Strategies to Drive Change. Wisconsin Medical Journal 2015; 114:135-142
Are There Hazards?

“… these applications do not take advantage of human-computer interaction principles, leading to poor designs that can increase the chance of error, add to rather than reduce work, and compound the frustrations of executing required tasks.

As a result, these applications sometimes increase workload, and they can introduce new forms of error that are difficult to detect.” (emphasis added)

Stead, 2009, National Research Council: “Computational Technology for Effective Healthcare”
Primary Care Needs Human Factors to:

- Understand the “basic science” of primary care: Cognition, social interactions and team function, communication and technology.
- Help design potentially useful interventions and improvements.
- Help design and conduct “laboratory testing” of proposed interventions and improvements.
- Help with monitoring systems in the real world when technology is deployed with special attention to unintended consequences.
Consider an analogy to developing a medication

• First understand the basic molecular and cellular biology of the disease and host
• Then design the medication around that understanding
• Then test the medication in the lab
• Then monitor the medication as it is used in practice to assess effectiveness and safety – and monitor for unintended consequences (side effects)

Like care innovations, this may be useful but...
Ciprofloxacin: Adverse Reactions

- **Serious Reactions**
  - anaphylaxis
  - anaphylactic shock
  - hypersensitivity rxn
  - skin rxs, severe (rare)
  - phototoxicity
  - seizures
  - pseudomembranous colitis
  - superinfection
  - incr. ICP
  - toxic psychosis
  - peripheral neuropathy (rare)
  - vasculitis (rare)
  - serum sickness (rare)
  - pneumonitis, allergic (rare)
  - hepatotoxicity, incl. fatal (rare)
  - nephrotoxicity (rare)
  - crystalluria (rare)
  - myelosuppression (rare)
  - blood dyscrasias (rare)
  - tendon rupture (rare)
  - arthropathy (animal studies)

- **Common Reactions**
  - nausea
  - diarrhea
  - vomiting
  - abdominal pain
  - headache
  - dyspepsia
  - dizziness
  - restlessness
  - lightheadedness
  - vaginitis
  - insomnia
  - photosensitivity
  - pruritus
  - rash
  - anxiety
  - agitation
  - confusion
  - tendinitis
  - arthralgia
  - elevated LFTs
Primary care – ISyE Collaboration (brief) History

- Started as informal collaboration in 2000
- Bentzi said, when observing primary care, that “It’s a mess!”
- Studies on
  - Quality of work life of clinicians and staff
  - Medical error reporting in primary care
  - Complexity & workflow in primary care
  - Systems & technology to support primary care
  - Hazards in primary care of elderly
  - RCT of a pre-visit planning intervention
The I-PrACTISE Vision

• Vision:
  • The care of patients will be improved and the practice of primary care medicine will become more efficient though new knowledge and techniques created by the collaboration between Industrial & Systems Engineering and the primary care specialties

“The Basic Science of Primary Care”
2013 I-PrACTISE Conference

- Conceived by Ben-Tzion Karsh, Ph.D.
- Develop a research agenda for advancing primary care practice using ISyE science.
- Method: brought together national experts in ISyE & Primary Care
- 75 Attendees
  - 29 were experts in primary care,
  - 27 experts in industrial engineering,
  - Related disciplines: psychology, nursing, pharmacy, administration, medical informatics
  - 10 graduate students – our future!

AHRQ Conference Grant: 1R13HS022170-01
2013 I-PrACTISE Conference

Addressing all Healthcare Needs
Team Based Care
Coordination & Integration
Access & Scheduling
Patient & Family Engagement
Health IT – CDS & EHR
Health IT – Registries & Exchanges

PCMH

3 Plenary Sessions
1st Working Session
Sharing Session
2nd Working Session
Sharing Session
3rd Working Session
Final Sharing Session

Qualitative analysis – themes/ideas

<table>
<thead>
<tr>
<th>Group Idea</th>
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<tbody>
<tr>
<td>Administrative pressure</td>
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<tr>
<td>Compensation/reimbursement</td>
</tr>
<tr>
<td>Complexity and scope of PC domain</td>
</tr>
<tr>
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</tr>
<tr>
<td>Compliance with regulatory</td>
</tr>
<tr>
<td>Degree of satisfaction in system</td>
</tr>
<tr>
<td>Distribution of administrative duties</td>
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<tr>
<td>Fear/apprehension</td>
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<tr>
<td>Improve rapidly and inexpensively</td>
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<tr>
<td>Increased depersonalization due to over-standardization</td>
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<tr>
<td>Innovations made without attention to associated tradeoffs</td>
</tr>
<tr>
<td>Methods/modes of communication</td>
</tr>
<tr>
<td>Presence of incentive programs</td>
</tr>
<tr>
<td>Relevant patient data access during scheduling process</td>
</tr>
<tr>
<td>Team climate</td>
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<tr>
<td>Usability of cognitive artifacts and tools</td>
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~140 Ideas
# Research Matrix

<table>
<thead>
<tr>
<th>Problems and Issues for Research</th>
<th>System Design Factors</th>
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<tbody>
<tr>
<td></td>
<td>Teams and Workload</td>
</tr>
<tr>
<td>Cognitive Needs</td>
<td>Technology</td>
</tr>
<tr>
<td>Patient Engagement</td>
<td>Policy</td>
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<tr>
<td>Community</td>
<td></td>
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<tr>
<td>Integration</td>
<td></td>
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<tr>
<td>Transitions of Care</td>
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</table>
## Cognitive needs

<table>
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<tr>
<th>Problems and issues for Research</th>
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<tr>
<td></td>
<td>Teams and Workload Distribution</td>
</tr>
<tr>
<td>Cognitive Needs</td>
<td>• Understanding and supporting the cognitive challenges in individual and team decision making</td>
</tr>
<tr>
<td></td>
<td>• Information flow during handoffs</td>
</tr>
<tr>
<td></td>
<td>• Handoffs across the system</td>
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**I-PrACTISE**

*Improving PrimAry Care Through Industrial and Systems Engineering*
Patient engagement

<table>
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<tr>
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<tbody>
<tr>
<td></td>
<td>Systems and Technology</td>
</tr>
<tr>
<td>Patient Engagement</td>
<td>Policy</td>
</tr>
<tr>
<td>• Understanding patient wants and needs</td>
<td></td>
</tr>
<tr>
<td>• Effective ways to present information and incorporate information from patient</td>
<td></td>
</tr>
<tr>
<td>• Involving patients in EHRs and creating registries</td>
<td></td>
</tr>
<tr>
<td>• Tools for shared decision making</td>
<td></td>
</tr>
<tr>
<td>• Assisting patients in finding resources</td>
<td></td>
</tr>
<tr>
<td>• Keeping pace with what is happening in the market place</td>
<td></td>
</tr>
<tr>
<td>• Conducting needs assessment</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Care Transitions</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Optimize care continuity</td>
</tr>
<tr>
<td>• Navigating multiple care transitions and interfaces</td>
</tr>
<tr>
<td>• Information flow during handoffs</td>
</tr>
<tr>
<td>• Handoffs across the system</td>
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## System Design Factors

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<tr>
<td></td>
<td>Teams and Workload Distribution</td>
</tr>
<tr>
<td>Community</td>
<td>• Reaching out to stakeholders and understanding their needs</td>
</tr>
</tbody>
</table>

### Care Transitions
- • Optimizing care continuity
- • Navigating multiple care transitions and interfaces
- • Information flow during handoffs
- • Handoffs across the system

### Teams and Workload Distribution
- • Clarification and optimization of team roles
- • Use of HIT within and across systems
- • Enhancing communication

### Technology
- • Incorporate care innovations
- • Involvement of stakeholders in quality improvement
Integration, Care transitions

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<tbody>
<tr>
<td></td>
<td>Teams and Workload Distribution</td>
</tr>
<tr>
<td>Integration</td>
<td>• Sustaining high performing teams</td>
</tr>
<tr>
<td></td>
<td>• Clarification and optimization of team roles</td>
</tr>
<tr>
<td>Care Transitions</td>
<td>• Optimize care continuity</td>
</tr>
<tr>
<td>Team-based Care</td>
<td>1. Do we need to refine our definition of healthcare?</td>
</tr>
<tr>
<td>----------------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>2. What population are we serving with our teams and when? This is likely dynamic.</td>
</tr>
<tr>
<td></td>
<td>3. How do we develop a model for team development and function? This should be informed by healthcare workers’ and patients’ perceptions, determination of the best team leader, maintenance of a patient-centric view, and apply to care beyond the healthcare site.</td>
</tr>
<tr>
<td></td>
<td>4. How do we engage patients as team members?</td>
</tr>
<tr>
<td></td>
<td>5. How do we implement new models of team-based care in clinical practices? Activating the care team not only when a patient presents for care.</td>
</tr>
<tr>
<td></td>
<td>6. How do we sustain high performing teams? Consider optimal use of feedback, reward systems, team performance metrics, evaluation of outcomes of care, and ongoing training.</td>
</tr>
</tbody>
</table>
Current I-PrACTISE Work

- Research
- Conference & Colloquia
- National Advisory Committee
- Links to Health Policy


We Need Human Factors to Develop Systems to:

• Support the non-linear workflow
• Reduce the “information chaos”
• Promote open-ended dialogue
• Support the understanding of context
• Support the development of SA
• Promote human relationships (Patients, staff and colleagues)

Poorly Designed Interventions Do Not Improve Care.

- “...no difference in performance between EHR users and non-users.”
- “..no consistent pattern between length of time using an EHR and physician’s performance.”
  - And these are just process measures, not patient outcome measures
  - Workload and errors not assessed.
- No subsequent studies have altered these findings

IT SAYS HERE THAT THE RATE OF MEDICAL ERRORS IS STUNNINGLY HIGH.

THAT EXPLAINS MY Hysterectomy.
Errors reduced or increased?

- 3% error rate with hand-written Rx, 13% with EHR Computerized Order Entry (CPOE).
- “The small number ... published to date do not provide ... evidence that CPOE systems enhance safety and reduce costs in the out-patient setting.
  - Increase guideline adherence
  - Increase prescribing time
  - Alerts are often ignored
    - And with good reason! [editorial comment]

Does Clinical Decision Support (CDS) Including Best Practice Alerts (BPAs) Help?

- No compelling evidence that overall CDS and BPAs are effective in improving quality in primary care.
  - Probably helpful to assist memory (e.g. medication interactions)
  - No evidence that helpful at supporting cognition (e.g. diagnosis)
- No exploration of unintended consequences: (e.g.)
  - Break in task
  - Lost of eye contact
  - Increased clinician fatigue


Good HF Would Help Reduce Break-in-Task

HF Would Help Reduce “Note Bloat”

<table>
<thead>
<tr>
<th>Medication</th>
<th>Sig</th>
<th>Disp</th>
<th>Refills</th>
<th>Start Date</th>
<th>End Date</th>
<th>Comment</th>
<th>D/C Reason</th>
<th>Route</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irbesartan (AVAPRO) 75 MG TABS</td>
<td>Take 1 tablet by mouth daily for blood pressure and kidney protection</td>
<td>30 or 60 tid</td>
<td>12/12</td>
<td>03/12/2009</td>
<td></td>
<td>Caution re Hx of allergic Rxn to Benazepril - but should be OK.</td>
<td>Oral</td>
<td></td>
</tr>
<tr>
<td>Desflornac (ENABLEX) 15 MG TB24</td>
<td>1 TABLET DAILY to reduce urinary urgency</td>
<td>30 or 60 tid</td>
<td>12/12</td>
<td>03/12/2009</td>
<td></td>
<td></td>
<td>Oral</td>
<td></td>
</tr>
<tr>
<td>Warfarin (COUMADIN) 2.5 MG TABS</td>
<td>Take 2 5mg daily except for 5mg on Wednesdays</td>
<td>30</td>
<td>6/0</td>
<td>03/12/2009</td>
<td>03/26/2009</td>
<td></td>
<td>Oral</td>
<td></td>
</tr>
<tr>
<td>Insulin aspart (NOVOLOG FLEXPEN) 100 UNIT/ML SOLN</td>
<td>As directed</td>
<td>60 or 30 tid</td>
<td>pm</td>
<td>02/09/2009</td>
<td></td>
<td>Subcutaneous</td>
<td>Oral</td>
<td></td>
</tr>
<tr>
<td>Hydrocodone-oxicodone (VOCODIN) 10-325 MG TABS</td>
<td>1-2 tablets every 4-6 hours as needed for pain</td>
<td>120</td>
<td>6/0</td>
<td>12/30/2008</td>
<td></td>
<td></td>
<td>Oral</td>
<td></td>
</tr>
<tr>
<td>Solifenacin (VESICARE) 10 MG TABS</td>
<td>1 TABLET DAILY to help with incontinence</td>
<td>30</td>
<td>12/12</td>
<td>12/15/2008</td>
<td></td>
<td></td>
<td>Oral</td>
<td></td>
</tr>
<tr>
<td>Ezetimibe-simvastatin (YTOFIN) 10-40 MG TABS</td>
<td>1 TABLET EVERY EVENING for cholesterol</td>
<td>30</td>
<td>11/11</td>
<td>12/12/2008</td>
<td></td>
<td></td>
<td>Oral</td>
<td></td>
</tr>
<tr>
<td>Hydrochlorothiazide (HYDOCHLUR) 25 MG PO TABS</td>
<td>1 TABLET DAILY for blood pressure and edema</td>
<td>100</td>
<td>3/3</td>
<td>10/29/2008</td>
<td></td>
<td></td>
<td>Oral</td>
<td></td>
</tr>
<tr>
<td>INSULIN ADMIN SUPPLIES N/A MISC</td>
<td>BD Ultra-lite III mini pen</td>
<td>200</td>
<td>1 year</td>
<td>10/20/2008</td>
<td></td>
<td>Does not apply</td>
<td>Oral</td>
<td></td>
</tr>
<tr>
<td>Potassium Chloride 10 MEO PO T/SOR</td>
<td>1 tablet three times daily</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Oral</td>
<td></td>
</tr>
<tr>
<td>Tunsolamide (LASIK) 40 MG PO TABS</td>
<td>1 tablet twice daily</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Oral</td>
<td></td>
</tr>
<tr>
<td>Tylenol 500 MG PO TABS</td>
<td>1 TABLET EVERY 4 HOURS AS NEEDED</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Oral</td>
<td></td>
</tr>
</tbody>
</table>
The Cost of Technology

Toll E., The Cost of Technology, JAMA 2012;307:2497-8
HF – The Computer a Bridge, Not a Barricade


Thanks to Ellen Evans, PA-C
HF – The Computer a Bridge, Not a Barricade

“...bring the patient directly into the interaction between the clinician and the computer; e.g., using the computer to facilitate conversation and adjusting room design to allow the patient to view the computer screen alongside the clinician.”


Adapted from: Ventres W, Kooienga S, Marlin R. www.aafp.org/fpm/20080300/6enir.html

Other Considerations in Redesign:

• Start with patient concerns: the patient before the computer.
  • UWMF Directive “The first thing you must do when you enter the patient’s room is log into the computer.” No way!

• Don’t let templates rule the encounter

• Watch out for auto-fill, smart phrases, copy-paste, etc.
  • Potential fraud
  • Potential for malpractice
  • Loss of situation awareness

Adapted from: Ventres W, Kooienga S, Marlin R.
www.aafp.org/fpm/20080300/6enir.html
HF Will Help Redesign to Avoid Cognitive Clutter

SUBJECTIVE:
XXXX is an 58 year old male who presents for evaluation and treatment of Type 2 diabetes mellitus. Age at diagnosis ***. Family history positive for diabetes in the patient’s {family members:20}. Previous treatment modalities employed include {treatment:1216}. Current treatment includes {treatment:1216}.

Current monitoring regimen: {monitoring:1217}
Home blood sugar records: ***
Last HgbA1c: ***
Diabetic complications: {complications:1215}
Cardiovascular risk factors: {CV risk factors:510}

Current outpatient prescriptions prior to encounter:
HYDROCODONE- 1-2 tablets every 4-6 Disp: 42 Rfl: 4

How about his knee arthritis and COPD which limit his exercise?, His wife’s depression? His corn crop? His daughter with developmental delay?
HF can Inform Optimal Use of Technology

• Use the EMR in the way that works for all
  • The goal is **NOT** to go paperless
  • The goal **IS** to improve patient care – and our lives -- through efficient, effective communication and information handling!

• The optimal use of technology includes when to **NOT** use it
  • Air France 447!
HF Will Help Define the Best Use of Technology!

Paper is not Evil!

“...screens are more cognitively...taxing than paper...People consistently report that when they really want to focus...they read it on paper.”

Keyboard recording “...results in shallower processing.” The “...tendency to transcribe ... verbatim rather than processing information and reframing it ...is detrimental to learning.”

HF Can Guide How We Enter Information (Narrative is Important)

• To our own understanding
  • (“sense making”, establishing Situation Awareness)

• To our communications
  • To Others – who care for patients

• To our patients

• We “connect the dots” with our narrative.
HF Will Encourage “Synchronous Analogue Communication”

Mundt MP, Gilchrist VJ, Fleming JF, Zakletskaia LI, Tuan W-J, Beasley JW. Effects of Primary Care Team Social Networks on Quality of Care and Costs for Patients with Cardiovascular Disease. Ann Fam Med 2015;13:139-148


Better Clinical Outcomes – including less ER visits!
HF Can Make the Case For Redesign to Support “Synchronous Analogue Communication”

• Encourage and support “Synchronous Analogue Communication” (i.e. talking with each other!)
  • Understanding is “…hampered by …a presumption that the … function of a handoff is one-way information transmission.”
  • There is a loss of “…co-construction of the understanding of the patient.”
  • Good care depends on accurate, succinct information.

HF Can Help Redesign Systems to Facilitate Team Care.

- A high-performing primary care team will have:
  - A stable team structure
  - Co-location of team members
  - Staffing ratios adequate to facilitate new roles
  - Efficient communication including team meetings, huddles, and minute-to-minute interactions
    - Less in-box stuff!
    - More rewarding dyadic conversations
    - Better team spirit


HF Encourages Dictation

“Some practices reported taking steps to address the causes of physician dissatisfaction with EHRs. These steps were, most commonly, to allow multiple modes of data entry (including scribes and dictation with human transcriptionists) and to employ other staff members (e.g., flow managers) to help physicians focus their interactions with EHRs on activities truly requiring a physician’s training."

(emphasis added)


http://www.rand.org/content/dam/rand/pubs/research_reports/RR400/RR439/RAND_RR439.pdf
Beasley JW, Danford C. Video on dictating in the presence of the patient. https://www.youtube.com/watch?v=KGHEdv0XGpE
(Or Google: “Beasley Dictating”)

My thanks to Mrs. C. who put up with me for 36 years!
HF Can Help Maintain Patient Engagement

- Clinicians rated as less effective when they spent more time looking at the computer and when there were more periods of silence in the consultation.
- Clinicians benefit from using communication strategies that maintain the flow of conversation when working with the computer.
- Remember: Phys Gaze Computer = Patient Gaze Other


HF Can Help Redesign Bring Lean Thinking to Physician Work

“Lean thinking begins with driving out waste so that all work adds value…” (Institute for Healthcare Improvement). One type of waste to be reduced is the waste of physician time and attention. There are several strategies that should be used to reduce this waste. Reasonable estimates of possible waste reduction include the following (with some overlap and based on an assumed 5-day work week):

**Waste Reduction Strategies:**
- Transcription with human assistance
  - Save 6 hours, 15 minutes each week
- Paper/verbal order entry
  - Save 3 hours, 20 minutes each week
- Automatic log-ins
  - Save 1 hour, 15 minutes each week

**Ten hours and 50 minutes saved each week (over 2 hours per work day), and more with clinical coaches (scribes) and co-location of staff.**

(Estimates from John w. Beasley, MD, Christine Sinsky, MD, Tom Sinsky, MD and Phil Bain, MD, James Jerzak, MD)
HF Can Protect our Young Physicians

- They think it’s reasonable…
  - To have to type during patient care
  - To use templates
  - To get lots of in-box stuff
  - To do clerical Work After Clinic hours (WAC!)
  - To be distracted from patients
  - To have minimal team culture
We are responsible for how we use technology

“My patient notes have always been communications with myself and a message in a bottle to my partners. I wanted to remember the things that stirred and touched me as well as the size of lesions…” (emphasis added)

“The Rollout of the EHR...will require that we use templates as much as possible.”

Employed Family Physician Satisfaction and Commitment to Their Practice, Work Group, and Health Care Organization

How Many Problems Do Family Physicians Manage at Each Encounter? A WReN Study

The Myth of Workflow in Primary Care: Implications for Health IT. Jamia, 2015

Quality of Work Life of Independent vs Employed Family Physicians in Wisconsin: A WReN Study