A to Z: A Year in Review

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Conflicts of Interest Disclosure

Sarah Collins PhD, RN and Patricia C. Dykes PhD, RN

Have no real or apparent conflicts of interest to report.
Learning Objectives

- Review purpose, objectives, search strategies and associated limitations.
- Review nursing informatics research topics, methods, findings and journals.
- Highlight gaps in nursing informatics research.
- Discuss opportunities for translating informatics evidence into clinical practice.
Purpose

To survey the published literature in the area of nursing informatics using the following criteria:

- Research (systematic reviews, RCTs, observational & qualitative research, case studies)
- Nursing informatics
- Published (including early e-published) in peer-reviewed journal between March 1 2015 – February 29 2016

To describe the corpus of publications collected in terms of:

- Author country
- Setting
- Topic
Search Strategies

- Databases: PubMed and CINAHL
- Terms: “nursing informatics” combined with keywords “research” and “interprofessional” narrowed to publication dates March 1 2015 – February 29 2016
- Inclusion criteria: Research, contributes to nursing informatics knowledge base, prototype development and testing, clinical care delivery focus; informatics
- Exclusions: Articles that focused on informatics education programs, nursing education, nursing students, competencies, simulation
Search Results

Records identified through database searching (n=590)

Records identified through NENIC members (n=17)

Records excluded because duplicates, not research/review or related to nursing education, nursing students, competencies (n=483)

Full text records assessed for eligibility (n=124)

Excluded on full review did not meet criteria (n=43)

Studies included in evaluation (n=81)
Journals (%)
Countries of First Author (%)
## Research Settings and Topics

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<th>Settings</th>
<th>Topics</th>
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<td>Other</td>
<td>Standards/Terminology/Interoperability/Health Information Exchange</td>
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<td>Mobile health (mHealth)</td>
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<td>Information Seeking/Needs/Appraisal</td>
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<td></td>
<td>Clinical Documentation</td>
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<td></td>
<td>Other</td>
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</table>
Research Settings %

- Long-term Care: 1%
- Health Professionals: 4%
- Ambulatory: 15%
- Community/Public Health: 16%
- Continuum: 23%
- Hospital: 41%


5. Gaudet CA. Electronic Documentation and Nurse-Patient Interaction.


8. Collins SA, Yoon S, Rockoff ML, Nocenti D, Bakken S. Digital divide and information needs for improving family support among the poor and underserved.


10. Stade D, Dykes P. Nursing leadership in development and implementation of a patient–centered plan of care toolkit in the acute care setting.


12. Phillips AB, Merrill JA. Innovative use of the integrative review to evaluate evidence of technology transformation in healthcare.


Highlighted Publications
Transitions

- **Topic:** Transitions
- **Purpose:** To describe a pilot project using HIT and secure messaging in Long Term Care (LTC) to facilitate electronic information exchange during care transitions
- **Methods:** Five LTC facilities were included, all located within Oklahoma and serviced by the same regional health system. The study duration was 20 months, with 6 month pre-intervention baseline data collection. CCO Health Information Exchange transmits data using HL7 standard in secure messaging system via Cerner Direct to transmit structured documents. Implemented an electronic clinical documentation tool (CDT) with CDS alerts for change in patient status, SBAR (Situation/Background/Assessment/Recommendation) documents, and universal transfer form (UTF). The CDT used in the study is a lightweight-hosted electronic point-of-care documentation tool that is wall mounted outside of a resident’s room. CDT could be sent to the state’s HIE, LTC facilities were also able to access the state HIE

- **Findings:** 83% of transfers used CDT tools. Inpatient readmission (33.6% to 12.5%) and return emergency department (ED) visit (85.3% to 14.1%) rates were lower than baseline following implementation.

- **Implications:** Easy to use, convenient system is critical for real-time documentation of early signs and symptoms that can be used to alert appropriate personnel to prevent and facilitate care transitions.
Topic: Transition

Purpose: To explore how the use of electronic messages support hospital and community care nurses' collaboration and communication concerning patients' admittance to and discharges from hospitals.

Methods: Descriptive, semi-structured interviews with hospital nurses and community care nurses. Thematic analysis related to three main topics: e-messaging: efficiency, quality, and safety. These topics were further divided into sub-themes.

Sample: 41 participants from one hospital and three adjacent communities.

Findings:

- Electronic messaging is more efficient (less time-consuming)
- Writing electronic messages raises awareness of content of the information exchanged
  - More conscious communication than oral communication
- Electronic messaging enables improved information security, but depends on nurses using the system as intended

Implications: Information and communication technologies can support nurses' work in the transition situations, and this is likely to benefit the patients.
Standards/Terminology/Interoperability/Health Information Exchange
Topic: Standards/Terminology/ Interoperability/ Health Information Exchange

Purpose: Collaborative project to develop common information models, terminology bindings, and term definitions based on nursing documentation systems, and to carry the findings through to the adoption in standards development organizations (SDOs) and technical implementations in clinical applications.

Methods: Nursing flowsheet documents from six large organizations were analyzed to generate common information model & terminologies that:
- Fully expressed documentation across all systems
- Sufficient for evidence-based decision support, reporting, and analysis.

Findings: Identified significant gaps in existing standards. The models and terminologies were submitted to and incorporated by standards development organizations, published, implemented, and now serve as a foundation for an eMeasure.

Implications:
- Standards do not yet fully address needs for detailed clinical data (e.g., CDS, reporting, analytics).
- Documentation artifacts can be used in a bottom-up approach to develop common models and sets of terms that are complete from the perspective of clinical implementation.

- **Topic:** Standards/Terminology/Interoperability/Health Information Exchange
- **Purpose:** To analyze health information exchange at skilled nursing facilities for clinical functions, the benefits and barriers, and the facility characteristics associated with health information exchange capabilities. **Methods:** Cross-sectional survey of nursing home administrators
- **Findings:** 39.30% response rate (156/397). Highest level of electronic exchange for clinical functions was intra-facility exchange, and more prevalent in for-profit skilled nursing facilities.
- **Identified barriers:** financial, technological, and connectivity
- **Identified benefits:** faster and accurate billing, improved care planning, and improved quality of documentation
Mobile Health
Topic: Mobile Health

Purpose: Usability evaluation of a mobile health system for diabetes patients

Methods: Modified heuristic evaluation technique of (1) dual-domain experts (healthcare professionals, usability experts), (2) validated scenarios and user tasks related to patients' self-care, and (3) in-depth severity factor ratings. [Nielsen J., Heuristic evaluation, 1994]

Findings: 129 usability problems with 274 heuristic violations for the system.

Implications: Consumer health systems and applications in mHealth should be evaluated for usability as well as medical adequacy. Demonstrated fast, resource-efficient and user-oriented heuristic evaluation method.

- **Topic:** Mobile Health

- **Purpose:** Integrative review of the evidence for mobile health Short Message Service text messages as an innovative and emerging intervention to promote medication adherence. Literature gap of evidence in guiding theories and content of text messages used in clinical practice.

- **Methods:** Searched CINAHL, Excerpta Medica dataBASE, Scopus, the Cochrane Library and PubMed were searched for relevant studies between 2004–2014.

- **Results:** 13 articles met inclusion criteria. “Doses” ranged widely: 3/day to 1 every 3 months. Adherence measured via self-report, Rx refill, Rx bottle opened. 9/13 studies found adherence rates improved between 15.3—17.8% when using text messages to promote medication adherence. Text messages that were standardised, tailored, one- or two-way and timed either daily to medication regimen, weekly or monthly showed improvement in medication adherence.

- **Implications:** Established a scientific basis for text messages as an intervention to improve medication adherence across multiple diseases. Future RCTs needed.

- **Topic:** Mobile Health

- **Purpose:** To conduct a national benchmarking survey of nurses working in intensive care telemedicine facilities in the United States.

- **Methods:** 2-phased study: 1) online survey to assess nurses' perceptions of intensive care telemedicine, and 2) modified 2-round Delphi study to identify priority areas.

- **Findings:** 1213 respondents “agreed” to “strongly agreed” that using tele-intensive care enables them to:
  - Accomplish tasks more quickly (63%)
  - Improves collaboration (65.9%)
  - Improves job performance (63.6%)
  - Improves communication (60.4%)
  - Useful in nursing assessments (60%)
  - Provides more time for patient care (45.6%)

  Benefits =>trend vital signs, detect unstable status, medical management, and enhance safety

  Barriers => technical problems, interruptions in care, perceptions telemedicine as interference, and staff attitudes.
Topic: Mobile Health

Purpose: To describe the device-related decisions and challenges faced including device and accessory selection, integration, information and device security, infection control, user access, and ongoing operation and maintenance.

Requirements:

- Device type and accessories
  - BEDSIDE access to devices
  - Patient/care partner access to PHI and ability to communicate with the team
  - Devices connection to Partners secure wireless network
- Device storage and user access
  - Easy access at all times (bed, chair, couch)
  - Easy to charge
  - Does not increase risk for adverse events (falls, infections)
- Device and information security
- Infection control procedures
  - Will not increase risk for infection
  - Devices must not be taken in/out of room for cleaning/processing (Albrecht, 2013)
Human Factors/Usability

- **Topic:** Human Factors/Usability
- **Purpose:** To explore nurses’ reactions to new novel technology for acute health care
- **Methods:** Exploratory descriptive design to capture nurses’ immediate impressions of novel technology. Four focus groups (52 nurses from medical and surgical wards at two hospitals in Australia; one private and one public).
- **Findings:** Wide variation across sites. Challenging reactions => perceived threat to clinical skill, and the potential capability of the novel technology to capture their clinical workflow. Enabling reactions => visions tool could help integrate care between departments; support of nursing processes; and coordinate care
- **Implications:** Nurse engagement in design

- **Topic:** Human Factors/Usability
- **Purpose:** Assess participants' reports of symptom occurrence using Sisom application compared to a standard symptom checklist and determine the time requirements, ease of use, and perceived usefulness of the Sisom tool by children with cancer and their parents.
- **Methods:** 100 dyads of patients 7–12 years of age and their parents. Child and parent participants completed both Sisom and the Memorial Symptom Assessment Scale. Symptoms on the two tools were compared and 20 items were similar to allow for comparisons.
- **Findings:** Children reported a significantly higher number of 20 symptoms using Sisom as compared to the checklist (i.e., 6.8 versus 4.9 symptoms, p < 0.001). A similar pattern was noted for parental proxy reports (i.e., 8.7 versus 5.7 symptoms, p < 0.001). Sisom was completed in less than 30 min, with high ratings of ease of use and perceived usefulness from parent participants.
- **Implications:** Sisom provides a systematic and engaging method to elicit symptom reports from children for use in clinical care and research.
Handoff

- **Topic:** Handoffs

- **Purpose:** To examine the relation between the strategies the nurses employ during handover and the number and types of treatment errors in patient care in the following shift.

- **Methods:** Prospective study. 200 randomly selected handovers in five internal wards from 2012–2013. Handover strategies previously adopted from High Reliability Organizations were assessed via observations; treatment errors – dosage discrepancy, order postponed, no documentation – captured from the patient's files and demographical data were collected via questionnaires.

- **Findings:** Average 20% of a patient's records included inaccurate medication dosage; in 30% of records a care order was fulfilled late; and ~50%, documentation was partially missing. Handover strategies varied substantially.

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Negative binomial regression analysis for predicting number of treatment errors (N = 200).</th>
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<tbody>
<tr>
<td></td>
<td>Model 1: controls</td>
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<tr>
<td>Variables</td>
<td>B</td>
</tr>
<tr>
<td>Departing nurse’s tenure</td>
<td>−0.010</td>
</tr>
<tr>
<td>Patient’s complexity score</td>
<td>−0.115</td>
</tr>
<tr>
<td>Ward</td>
<td>0.606*</td>
</tr>
<tr>
<td>Face-to-face verbal update with interactive questioning</td>
<td></td>
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<tr>
<td>Update from practitioners other than the outgoing</td>
<td></td>
</tr>
<tr>
<td>Limit interruptions during update</td>
<td></td>
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<tr>
<td>Topics initiated by incoming and outgoing</td>
<td></td>
</tr>
<tr>
<td>Include outgoing team’s stance on care plans</td>
<td></td>
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<tr>
<td>Outgoing writes summary prior to handover</td>
<td></td>
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<tr>
<td>Outgoing participated in medical round</td>
<td></td>
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<tr>
<td>Incoming check medical equipment</td>
<td></td>
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<td>Log likelihood Δ</td>
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*P < 0.05; **P < 0.01.
Topic: Handoff

Purpose: Review available literature that supports implementing bedside clinical handover in nursing clinical practice and identify key issues.

Methods: Integrated literature review of 45 articles.

Findings: A number of clinical handover mnemonics are available that provide structure to the process. Areas such as confidentiality, inclusion of the patient/carer and involving the multidisciplinary team remain issues for practitioners in implementing good clinical handover practices.

Implications: Remains a lack of literature available about the transfer of responsibility and accountability during clinical handover and auditing practices of the clinical handover process. Nurses were more concerned about confidentiality issues than were patients. Multidisciplinary approaches were recommended by a few authors, but research indicated they were poorly implemented. The use of a structured tool was strongly supported; however, no one singular tool was considered suitable for all clinical areas.
Consumer Health

### Overview of Patient Information Sharing by Country

<table>
<thead>
<tr>
<th>Country</th>
<th>Maturity of Pt Engagement</th>
<th>Government Involvement</th>
<th>Patient Portal Strategy</th>
<th>National Patient Identifier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Europe</td>
<td>Emerging–established</td>
<td>Moderate–major</td>
<td>Institutional–National</td>
<td>Yes (except Switzerland)</td>
</tr>
<tr>
<td>Asia</td>
<td>Limited–established</td>
<td>None–minor</td>
<td>Institutional–Regional</td>
<td>Yes (except Japan)</td>
</tr>
<tr>
<td>S. America</td>
<td>Emerging</td>
<td>None–moderate</td>
<td>Limited–Institutional</td>
<td>Yes (except Brazil)</td>
</tr>
<tr>
<td>N. America</td>
<td>Established</td>
<td>Moderate–major</td>
<td>Institutional–Regional</td>
<td>Yes (Canada) No (USA)</td>
</tr>
<tr>
<td>Australia</td>
<td>Established</td>
<td>Major</td>
<td>National</td>
<td>Yes</td>
</tr>
<tr>
<td>Africa</td>
<td>Limited</td>
<td>None</td>
<td>None</td>
<td>Yes</td>
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</table>

- **Topic:** Consumer health and Patient Engagement
- **Purpose:** To investigate whether the quality of the eMAR improves when patients use a patient communication tool linked to their eMAR (eMAR–PCT) to communicate asynchronously with the pharmacist about errors.
- **Methods:** Polypharmacy patients (> / = 5 medications) randomly selected and invited to use their eMAR–PCTs. Participants received 2 digital questionnaires assessing health and self-care (week 0 and 26). Statistical analyses were performed on two subgroups: eMAR–PCT users and non-users.
- **Findings:** 43.5% (n = 152) of invited participants accepted (56% women). Among the eMAR–PCT users, 75% logged in more than once, and 17.9% communicated asynchronously with the pharmacist. No improvement in the quality of the eMAR was found. The self-care variables self-efficacy (p = .006) and collaboration with the pharmacist (p = .021) improved more in the users group.
- **Implications:** Modest patient participation; more work needed to better understand why some patients choose not to participate in these types of evaluations.

- **Topic:** Consumer Health
- **Purpose:** To describe the use of social media during the antepartum and postpartum periods among first-time African American mothers and their support persons.
- **Methods:** A qualitative critical ethnographic research design. African American participants recruited from community-based, public health, and home visiting programs (n=14 Pregnant women; n=8 support persons).
- **Findings:** Frequently used social media for education and social support. Searched Internet for perinatal and parenting information. Most participants reported using at least one mobile application during perinatal period. Participants recalled many facts re: infant development. Did not recall information about feeding.
- **Implications:** Social media are an important vehicle to disseminate infant feeding information; however, they are not currently being used to full potential. The increasing popularity and use of social media platforms offers the opportunity to create more innovative, targeted mobile health interventions for infant feeding and breastfeeding promotion.
Purpose: To compare the effectiveness of the HELPP (Health, Education on Safety, and Legal Support and Resources in IPV Participant Preferred) intervention among IPV survivors.

Methods: Mixed-methods design. Participants randomly assigned to: 1) Online (ONL), 2) Face-to-Face (FTF), or 3) Waitlist Control (WLC). Outcome measures: anxiety, depression, anger, personal, and social support. The HELPP intervention was offered to 32 adult female participants (45% Asian, 32% White, 22.5% Black).

Findings: The HELPP intervention (1) decreased anxiety, depression, anger, and (2) increased personal and social support in the ONL group. The WLC participants displayed (1) increased levels of anxiety, depression, and anger and (2) decreased levels of personal and social support, post-intervention.

Implications: The HELPP information and intervention was shown to be feasible, acceptable, and effective among IPV survivors compared with participants in the WLC group. Additional research needed to determine most effective delivery modes (e-mail alone or e-mail plus mobile devices).


**FIGURE 1.** WHO Ecological Model: A conceptual framework.

- **Topic:** Consumer Health–Nurses Use of Electronic Personal Health Records (ePHRs)
- **Purpose:** To examine the personal adoption of ePHRs by nurses.
- **Methods:** Survey disseminated to members of the AMIA and HIMSS Nursing Informatics listservs. Multiple logistic regression used to identify factors associated with ePHR use.
- **Findings:** 72% of 183 respondents were ePHR users. Nurse characteristics associated with electronic PHR use:
  - older (aged >50 years)
  - highly educated (72% master’s or doctoral degrees)
  - hold positions as clinical informatics specialists or chief nursing informatics officers
  - healthcare providers used electronic health records
  - less concerned about privacy of health information online
- **Implications:** Informatics nurses with expertise in and enthusiasm for the ePHRs can promote the adoption and use among healthcare providers and patients and influence design to address barriers to use.
Implementation
Implementation Evaluation

Purpose: To determine whether implementation of a bar-code medication administration process could improve the safety of medication administration.

Methods: Pre-post comparative design. Hypotheses: Implementation of bar-code medication administration would:

1. Increase real-time medication administration documentation
2. Decrease medication administration-related errors
3. Increase Workstation on Wheels usage at the bedside for medication administration
4. Increase use of the electronic medication administration record for medication retrieval.

Findings: Increase in use of the Workstation on Wheels at the bedside as well as real-time documentation. No increase in use of the electronic medication administration record to retrieve medications. Medication errors (time, dose, route) showed a slight rate increase and wrong medication slightly decreased.

Implications: Several limitations of the technology may have impacted findings. The dispensing cabinet and eMAR databases were not in sync so nurses were required to check eMAR when removing meds and did this <50% of the time. Nurses relied on handwritten notes re: meds/dose/route.

Clinical Documentation

**Purpose:** To examine if nurses' perceptions of the impact of healthcare information technology (IHIT) on their practice mediates the relationship between electronic nursing care reminder use and missed care.

**Methods:** Survey design with a convenience sample of RNs from teaching hospital in Southeast Michigan. Surveys: The MISSCARE, Nursing Care Reminders Usage and the IHIT scales. Multiple regression equations used for analysis.

**Findings:** 165 nurses responded to survey. Missed nursing care, the outcome variable, was regressed on the predictor variable, reminder usage, and the mediator variable impact of technology on nursing practice. The impact of healthcare information technology (IHIT) on nursing practice negatively affected missed nursing care ($t = -4.12$, $p < .001$), explaining 9.8% of variance in missed nursing care. With IHIT present, the predictor (reminder usage) was no longer significant ($t = -0.70$, $p = .48$). Thus, the reduced direct association between reminder usage and missed nursing care when IHIT was in the model supported the hypothesis that IHIT was at least one of the mediators in the relationship between reminder usage and missed nursing care.

**Implications:** The perceptions of the impact of healthcare information technology mediates the relationship between nursing care reminder use and missed nursing care. Perceptions regarding impacts of the technology will influence usage.
Clinical Decision Support
Clinical Decision Support - Nursing

Purpose:
To understand requests for nursing CDS interventions at a large integrated health system undergoing vendor-based EHR implementation. To establish a process to guide short-term implementation and long-term strategic goals to meet nursing CDS needs.

Methods:
Environmental scan of current state of nursing CDS including literature review and analysis of enterprise-wide CDS requests. Existing high priority CDS and paper-based tools used to guide decision-making were identified and categorized.

Findings:
A total of 46 nursing CDS requests were identified.
- 50% related to “Risk Assessments/Risk Reduction/Promotion of Healthy Habits”
- 56% specific to a clinical specialty
- 22% focused on facilitating inpatient clinical consults.

The types of nursing CDS needs were classified using the Data-Information-Knowledge-Wisdom Framework: 1) facilitating data capture, 2) meeting information needs, 3) guiding knowledge-based decision making, and 4) exposing analytics for wisdom-based clinical interpretation by the nurse.

Implications:
Nursing CDS is embedded in paper-based documentation tools and requires a long-term strategic plan including collaboration and engagement with clinical sites to address immediate, short-term, and long-term plan for optimizing CDS overtime. The Data-Information-Knowledge-Wisdom Conceptual Framework in conjunction with the High Priority Categories were useful for meeting short-term nursing CDS needs and aligning with the enterprise strategic plan.


### Data Information Knowledge Wisdom Categorization Results for Nursing CDS Requests

<table>
<thead>
<tr>
<th>Framework Concepts</th>
<th>Request Rates (n/total)</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data</td>
<td>4% (2/46)</td>
<td>Medication information/Micromedix</td>
</tr>
<tr>
<td>Information</td>
<td>56% (26/46)</td>
<td>Alerts pertaining to lab values that affect medication administration</td>
</tr>
<tr>
<td>Knowledge</td>
<td>33% (15/46)</td>
<td>CDS that recommends evidence-based nursing interventions to the operating room nurse.</td>
</tr>
<tr>
<td>Wisdom</td>
<td>7% (3/46)</td>
<td>Sepsis alert</td>
</tr>
<tr>
<td>Total</td>
<td>100% (46/46)</td>
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</tr>
</tbody>
</table>

**Fig. 1** Nursing CDS needs along the Data-Information-Knowledge-Wisdom (DIKW) Framework
Summary

- In Spring 2015–Winter 2016 nursing informatics research was published on a wide variety of topics and in informatics, nursing and health care journals.

- The 3 most common research topics were Consumer Health, Mobile Health, and Standards/Terminology/HIE.

- Fewer studies published on Transitions/Handoff, Human Factors/Usability.

- Continued trend towards “mainstreaming” of informatics literature

- More diversity in research settings (↑Ambulatory, ↑Continuum, ↓Hospital)

- More contributions by NENIC members to informatics research literature!
Summary: NENIC Contribution

More research related to Clinical Decision Support for nurses to close the gap identified in 2015:


Summary: Nursing Informatics Research Gaps

- Very few research publications related to the following:

  1. Rigorous evaluation of the impact of HIT on nursing care and patient outcomes

  2. Big data
Discussion Questions

- What studies did we miss?
- Which of these studies have relevance for your practice?
- What are the barriers to implementing the findings from these studies?
- What additional recommendations do you have for future research?
- What opportunities exist for multisite evaluation studies now that many organizations have implemented EHRs?
Questions?

Thank You!

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