

Grand Challenges for Clinical Decision Support:

A 2012 Perspective

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Why this topic

- Aperiodic reviews
 - Grand challenges perspective in 2008
 - Sittig DF, Wright A, Osheroff JA, Middleton B, Teich HM, Ash JS, Campbell E, Bates DW. Grand challenges in clinical decision support. JBI, 2008;41(2):387-392
 - Lobach et al, AHRQ study on evidence-based reviews of CDS effectiveness, 2011
 - Teich review of state of the art at AMIA meeting, Oct 2011
- What is new about current environment?
 - Convergence occurring in semantic interoperability work
 - Large players, with large aggregate databases becoming more robust
 - Potential for population-based CDS
 - PCMH and ACO focus on integrating care across episodes
 - Meaningful Use initiatives and quality focus
 - Ascendancy of an “app” culture with ubiquitous access
 - Emerging efforts at integrated view of patient record



Top 10 list of challenges

Framework

1. Scope of care process
2. Forms of CDS delivery
3. Patient-centered and shared decision making

Knowledge sources

4. Development, formalization, and incorporation of CDS knowledge
5. Dissemination of best practice knowledge
6. Knowledge management tools and resources
7. Population data

Use

8. Modes of integration to support interoperability and widespread use
9. Usability and effectiveness
10. Safety, quality, regulation, and liability



1. Scope of care process

- Consider whole care continuum
 - Including health and wellness
- Data model for longitudinal patient record
 - Everything is now focused on EHRs, CCDs, PHRs as separate entities
 - Need single integrated data view
- Need for single source of truth
 - Reconciliation for meds, problems, care plans, reliable timelines
 - Management of roles/responsibilities for data access, entry, update



2. Forms of CDS delivery

Research on forms of CDS and their effectiveness – new modes and refinement of old modes

Advice tools

- Rules – setting-specific adaptation, localization, embedding
- Guidelines, protocols, flow sheets – workflow tools
- Calculations, algorithms, etc.
- Prediction models, fuzzy models, machine learning models
- Population-based comparisons
- Incorporation of genomic data

Information tools

- Enhanced visualization, summarization – graphics, trends, dashboards
- Information retrieval – infobuttons, question-answering systems – refinement based on context
- Feedback, quality reporting
- Role of social networking?

Structured/mnemonic resources

- Order sets
- Structured documentation/reporting
- Structured encounters/templates for data capture
- Extraction of findings from narrative reports



3. Patient-centered and shared decision making

- How to respond to drug risk ads, genetic questions, etc.
 - <http://youtu.be/HSqRBMjEWvY>
- Sites for cardiac, cancer, other risks, genome profiling sites
- Emergence of personal sensors, home healthcare
- Role of patient in entering and updating health information
- What kind of CDS and guidance can be automated for patients, what to escalate



4. Development, formalization, and incorporation of CDS knowledge

- Transition from EBM studies to guidelines (narrative) to formalized knowledge to implemented CDS
 - GEM/GLIDES
 - eRecommendations project
 - GLIF, *Proforma*
 - CDSC, SHARPC 2B projects
- Standards
 - Order sets
 - Infobutton manager
 - Data model – vMR
 - DSS SOA standard
 - Still no executable guideline standard
 - No healthcare workflow model
 - Need for context/setting model
- Need better understanding of where GLs fit in care process, when patients are on or fall off of them
 - SAGE project
 - Decomposition
 - A GPS analogy

A possible paradigm: Guidance a la GPS

GPS car navigation system



- Goal/target specified
 - based on setting, problem, care plan if they already exist
 - can be suggested by system
- Alternative approaches offered
- Tracking of data & actions
 - degree to which goal is being met
 - midcourse corrections
- Information resources offered
 - both along path & at destination
- Useful both off-line & on-line



5. Dissemination of best practice knowledge

- Authoritative knowledge base(s)
 - Governance/oversight/peer review
 - Who maintains and updates
 - How/when updated
 - How disseminated
 - Where should the knowledge live (or the shared data on which it can be derived)
 - Intellectual property and copyright
 - Role of knowledge vendors



6. Knowledge management tools and resources

- What KM tools should be available
- How provided
- How interface with local KM resources
- How local sites and vendors can best leverage/adapt general knowledge
- How support local processes by capturing and disseminating best practice usage experience



Setting-specific factors:

How, When, Who, Where ... and Refinement of the What

- Triggering/identification modes
 - On chart open, on lab test result , on provider login, ...
 - Registry, periodic panel search, patient list for day, ...
- Inclusions, exclusions
 - To be more patient-specific
- Interaction modes, users, settings
- Timing considerations
 - Advance, late, due now, ...
- Data availability/ sources/ entry requirements
- Thresholds, constraints
- Actions/notifications
 - Message, pop-up, to do list, order, schedule, notation in chart, requirement for acknowledgment, escalation, alternate. ...
- Exceptions
 - Refusal, lost to follow up, ...



7. Population management

- Temporal modeling of longitudinal databases
- Prediction models
- Direct retrieval of cohorts
- Using cohort to structure the encounter
- How to update population-based best practices recommendations when new evidence comes along

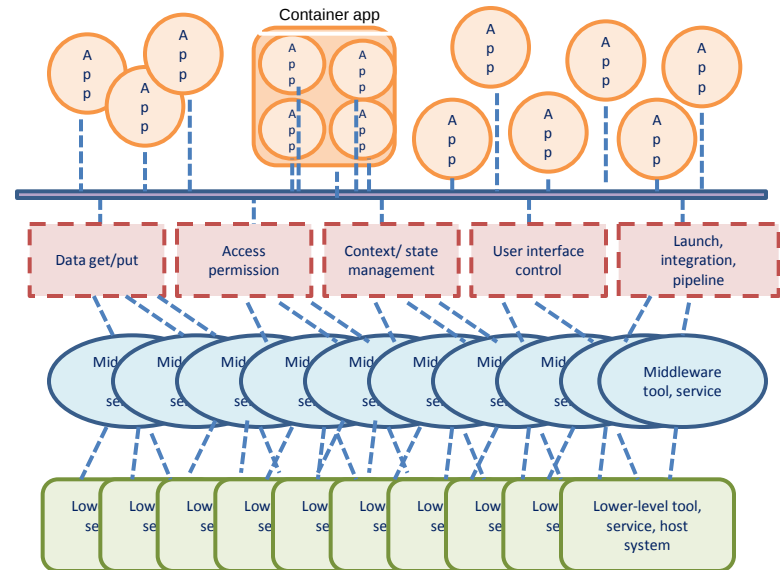
8. Modes of integration to support interoperability and widespread use

- Overcome platform dependence
- Share best practices
- Take advantage of mobile platforms, ubiquitous computing
- Approaches based on apps, services, integration with vendor platforms
 - Encourage innovation



Interoperable development and deployment initiatives

- AppWorks
(ASU/Mayo-led cooperative project)



- SMART (Harvard SHARP) project
- OpenCDS project (Kawamoto, Utah)
- VA/DoD integrated platform



9. Usability

- Capture and representation of context
- Setting, interface, visualization, intended user, platform constraints, patient specificity
- Workflow, team cognition, handoff
- Abstraction of features of user experience in successful environments for sharing

Approaches to usability

Screenshots removed in distribution copy

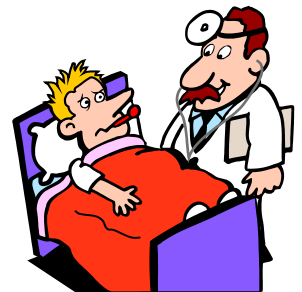


Care continuity and coordination (CCC) – a key potential paradigm shift

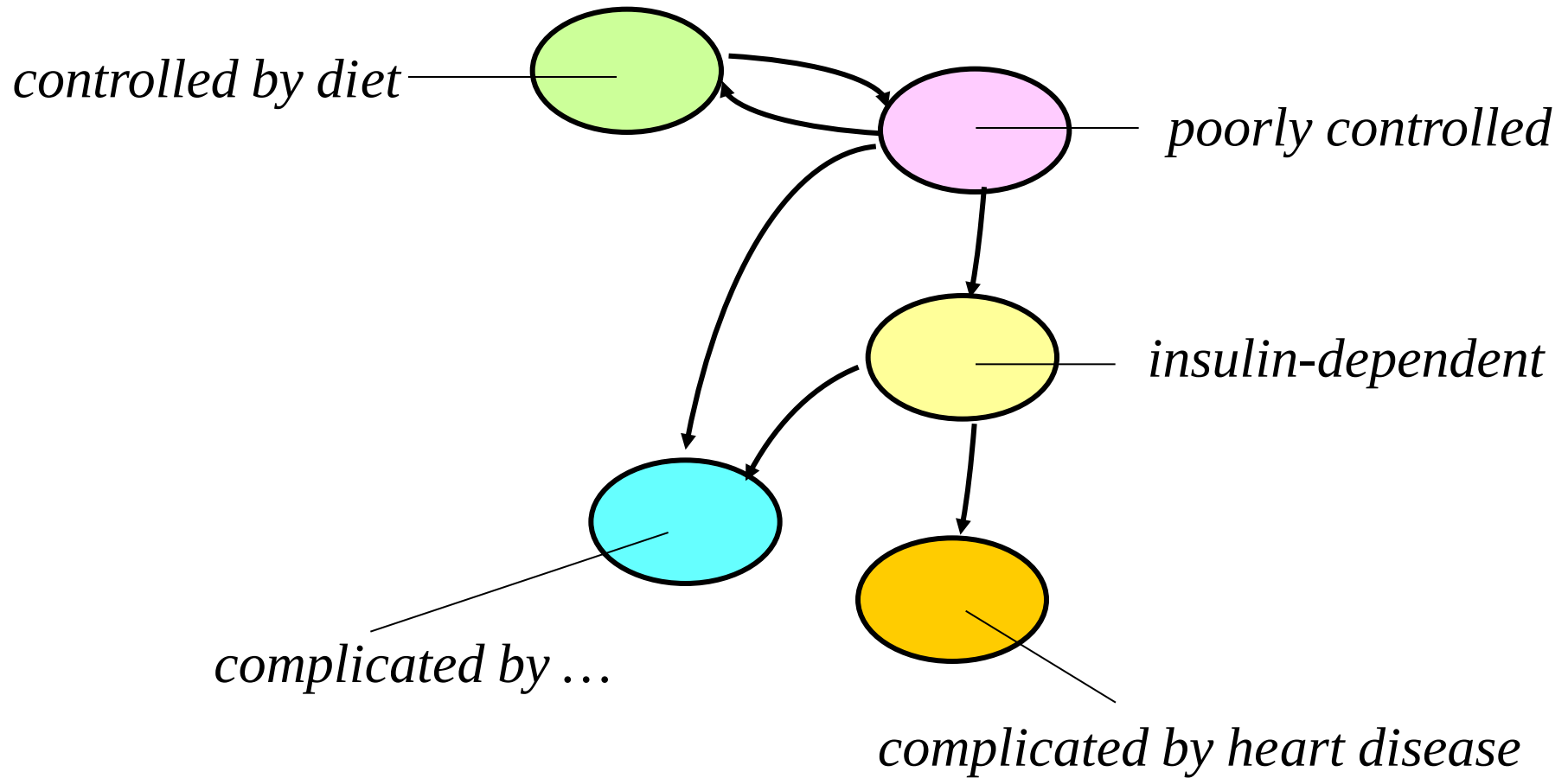
- Need for CCC especially in:
 - patients with chronic disease
 - patients with multiple problems
 - multi-specialty care
 - critical care
 - or any team-based care situation
 - management across episodes and in/out of hospital
 - PCMH/ACO focus
- EHR poorly suited to this
 - reviewing results, writing notes, ordering tests and treatments, updating problem list are all separate tasks
 - need for new paradigm
 - back to the future: a problem-oriented medical record!
 - transaction/dashboard-focused
 - documentation as by-product of actions

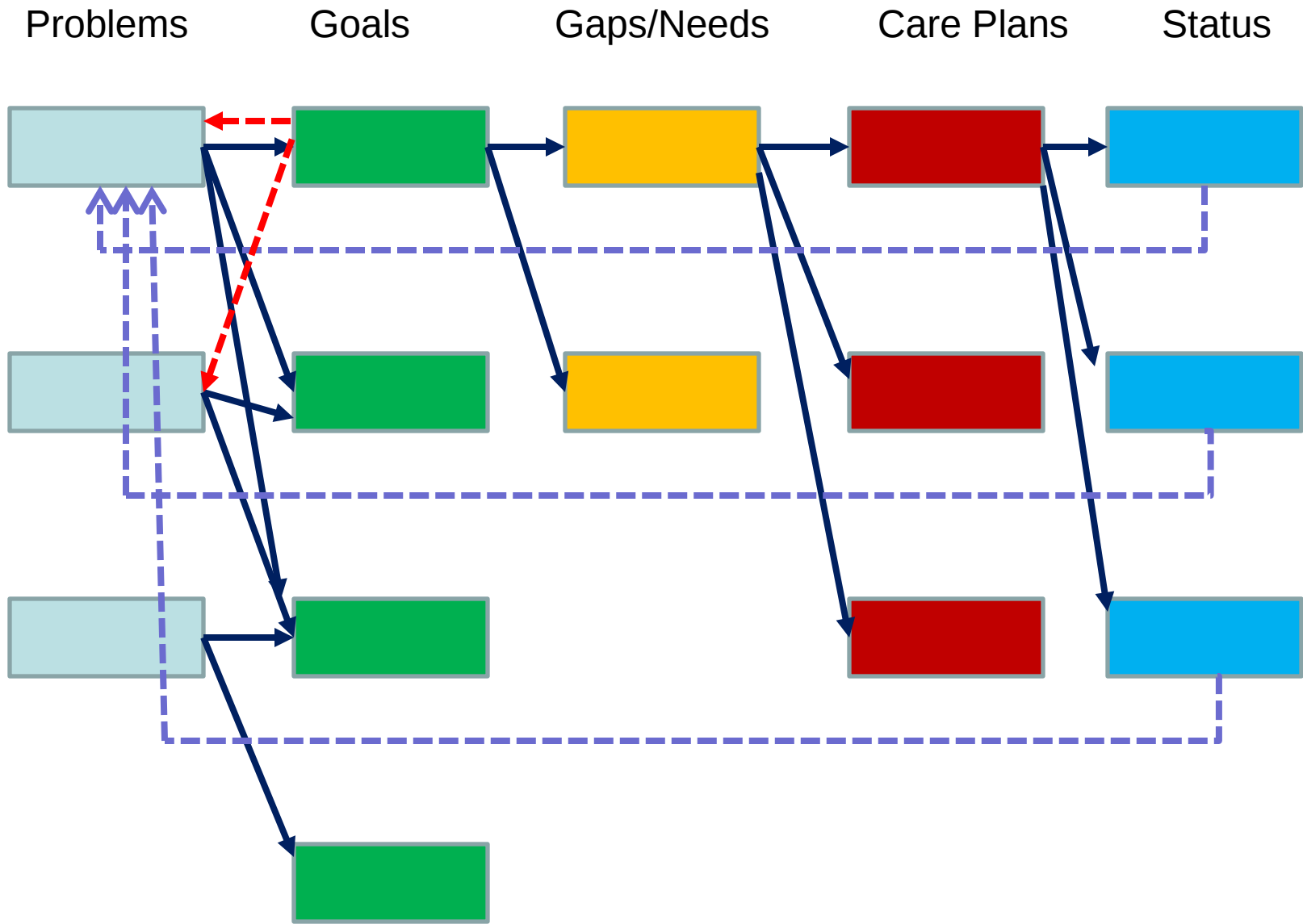
State-based encounter

- “Clinical management states”
 - problems at various stages of evolution or treatment
- Frequently occurring states correspond to typical encounters
 - relevant data elements identified
 - guidelines used to suggest likely assessments, plans
- Provides framework for organizing clinical data & other pertinent info



Example: Diabetes







10. Safety, quality, regulation, and liability

- What kinds of CDS are safe for patient direct use?
- Role of advice directly from system to patient
- When is CDS a black box?
- What is standard of care?
- Use of quality reporting and feedback to drive care improvement
- Relation between quality measures and CDS
 - Reactive vs. proactive
 - But opportunity to synchronize to drive improvements



A goal: Make CDS invisible

- Guide care process
- Anticipate user needs
- Make right thing the easy thing to do
- Facilitate auto-documentation, auto-order, auto-schedule, auto problem list update
- Focus on usability
 - Apps, visualizations, analytics



Roles of NLP

- Question-answering systems, info buttons
- Finding cases for interventions
 - Identifying problems
- Detecting adverse events
- Finding data needed for CDS
- Integrating diverse sources for CDS
 - e.g., Wagholikar K, et al.
 - Clinical decision support with automated text processing for cervical cancer screening. JAMIA, in press
 - similar paper on colorectal cancer screening, submitted
- The tradeoff issue
 - Documentation easier if notes less structured
 - But for chronic disease with CCC approach, more benefit from structure
- Potential role of voice for navigation and completion of structured templates
 - Selection of options, translation to standard concepts



Roles for probabilistic techniques

- Inference tools – prediction models, fuzzy logic, bayesian modeling, machine learning
- Cohort characterization – for population management
 - Identifying outliers, high-risk patients, those requiring individualized care, detecting adverse events
 - In conjunction with NLP methods
- Direct CDS use of cohorts for analyzing “patients like mine”
- Annotation of current state based on temporal modeling of sparse data in record



Conclusions

- CDS landscape has greatly changed
- We have new opportunities to rethink the care paradigm
 - Integrate diverse data and knowledge sources
 - Focus on usability, CCC
 - Design CDS to support these tasks
 - Develop interoperable apps to foster innovation
- Important roles for NLP and probabilistic techniques