From Care Plans to Care Coordination: Opportunities for Computer Support of Teamwork in Complex Healthcare

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Harvard School of Engineering and Applied Sciences

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The Care for Children with Complex Chronic Conditions

- Neurologist
- Physical Therapist
- Speech Therapist
- GI
- Primary Care Provider
- Parents
- Health aide
- Teacher
- School nurse
- Camp counselor
The Care for Children with Complex Chronic Conditions

The Problem: care for children with complex conditions is poorly coordinated, leading to unmet health needs and preventable health care crises.
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### Team-Based Care Plans for Improved Coordination (LPFCH, 2014)

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**Rationale:** everybody “on the same page”

**In practice:** rarely deployed or consulted
Contributions

• A qualitative study of complex care teams
  – Care coordination challenges
  – Barriers to effective care plan implementation
Contributions

• A qualitative study of complex care teams
  – Care coordination challenges
  – Barriers to effective care plan implementation

• Defining “FLECS” teamwork characteristics
Contributions

• A qualitative study of complex care teams
  – Care coordination challenges
  – Barriers to effective care plan implementation

• Defining “FLECS” teamwork characteristics

• Foundations for technology design based on a computational teamwork theory
Study of Complex Care Teams

- Goal: understand care coordination challenges
- Interviews and observations of team members:
  - Parents (13)
  - Primary care providers (4)
  - Specialists (4)
  - Therapists (8)
  - Care coordinator (1)
  - Program directors (2)
  - Family services coordinator (1)
  - Social worker (1)
- Analyzed using affinity diagramming
Barriers to Effective Care Plan Use: Complex Teamwork in Complex Care

“FLECS” teamwork characteristics:

- **F**lat-structure of team
- **L**oosely coupled plans and activities
- **E**xtended duration of plans
- **C**ontinual distributed revision of plans
- **S**yncopated time scales
Flat Structure

No single person in charge:

“We have different goals for different specialists; it is hard to keep track.” (parent)

Need to prioritize goals because “everyone wants to work on everything.” (parent)
Loosely Coupled Activities

Loose coupling makes appropriate information sharing hard:

“There isn’t an example when I wasn’t missing information” (specialist)

“We need to relay information back and forth...” (parent)
Extended Duration, Continual Distributed Plan Revision

No mechanism to support plan revision:
Full-team meetings “totally not scalable”
(specialist)

“All the status chats have to be provider initiated, and so if you don’t remember to do it or there’s no one coordinating it, it’s like where is it going, where do you even look for it?” (specialist)
Syncopated Time Scales

Different frequencies of seeing the patient

– Primary care providers: 3 to 4 times a year
– Specialists: 2 to 3 times a year
– Therapists: 1 to 3 times a week
Syncopated Time Scales

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Different information needs:

“A doctor asks if she is walking and expects a yes/no answer; a physical therapist will ask how she is walking and how much progress she has made.” (parent)
Team-Based Care Plans: Ideal vs. Reality

- FLECS teamwork poses coordination challenges
Team-Based Care Plans: Ideal vs. Reality

- FLECS teamwork poses coordination challenges
- Principles for successful care plan use do not hold:
  - “The plan of care is systematized as a common, shared document; it is used consistently by every provider…”
  - “The team monitors progress against goals, provides feedback and adjusts the plan of care on an ongoing basis…”
  - “Family-centered care teams can access the information they need to make shared, informed decisions.”
Team-Based Care Plans: Ideal vs. Reality

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Team-Based Care Plans: Ideal vs. Reality

- FLECS teamwork poses coordination challenges
- Principles for successful care plan use

**EXPECTATIONS**

- "The plan of care is systematized as a common, shared document; it is used consistently by every provider…"
- "The team monitors progress against goals, provides feedback and adjusts the plan of care on an ongoing basis…"
- "Family-centered care teams can access the information they need to make shared, informed decisions."

**REALITY**

How can technology better support such complex teamwork?
Technology for Supporting Teamwork

FLECS teamwork goes beyond prior work

• Supporting healthcare teams
  – Temporal coordination (Bardram 2000)
  – Centralized re-planning (Bardram 2010)
  – Mobile home care teams (Pinelle & Gutwin 2006)

• CSCW and social science teamwork theories and tools (Hutchins 1996; Star & Griesemer 1989; Hinds and McGrath 2006; Reddy & Spence 2008;...)

Foundations for Design of Systems to Support Complex Care Teams

**SharedPlans** (Grosz & Kraus 1996) :
A computational theory of collaboration

“..the capabilities needed for collaboration cannot be patched on but must be designed in from the start. " 
SharedPlans Representation

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follow family priorities

move to oral feeds

improve mouth muscle tone

adjust formula

arrange equipment

funding & transportation

go on family trip

{parents, primary care provider, specialists, therapists, community members}

{primary care provider, gastroenterologist, occupational therapist, nutritionist}

{primary care provider, physical therapist, social worker}

{...}
### Shared Plans Representation

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  - Adjust formula for weight gain

- **go on family trip**
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  - Arrange funding and transportation

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**funding & transportation**

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- **adjust formula**
  - {...}

- **arrange equipment**
  - {...}

- **go on family trip**
  - {primary care provider, physical therapist, social worker}

- **funding & transportation**
  - {...}
Agreement on High-Level Approach, Mutual Beliefs

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Agreement on High-Level Approach, Mutual Beliefs

- **move to oral feeds**
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  - adjust formula

- **go on family trip**
  - funding & transportation
  - arrange equipment

- **follow family priorities**
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- **…**
  - {primary care provider, gastroenterologist, occupational therapist, nutritionist}
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Agreement on High-Level Approach, Mutual Beliefs

**Current Systems:**
care plans are not integrated
no adaptation of plan information
Agreement on High-Level Approach, Mutual Beliefs

Current Systems:
care plans are not integrated
no adaptation of plan information

Opportunity for Technology Support:
make care plan “ever-present”
adapt presentation to team members
Dynamically Evolving Plans
Dynamically Evolving Plans

- follow family priorities
  - {parents, primary care provider, specialists, therapists, community members}
- go on family trip
  - {primary care provider, physical therapist, social worker}
- move to oral feeds
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Dynamically Evolving Plans

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- Adjust formula
  - ...

- Go on family trip
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Dynamically Evolving Plans

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  - ...
Dynamically Evolving Plans

Current Systems:
static, flat representation
Dynamically Evolving Plans

Current Systems:
static, flat representation

Opportunity for Technology Support:
dynamic plan structure
support revision and expansion
Communication and Coordination

- move to oral feeds
  - improve mouth muscle tone
  - adjust formula
- go on family trip
  - funding & transportation
- follow family priorities
  - {parents, primary care provider, specialists, therapists, community members}
  - {primary care provider, gastroenterologist, occupational therapist, nutritionist}
  - {primary care provider, physical therapist, social worker}
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primary care provider, gastroenterologist, occupational therapist, nutritionist

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Communication and Coordination

- Move to oral feeds
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- Arrange equipment
  - Physical therapist, social worker

{...}
Communication and Coordination

Current Systems:
little organization and context
information overload
Communication and Coordination

Current Systems:
little organization and context information overload

Opportunity for Technology Support:
improved information sharing interfaces reasoning about team members’ context
Key Roles for Technology for Supporting Complex Care Teams

• Make the care plan “ever present”
• Support plan revision and expansion
• Support efficient information sharing
Key Roles for Technology for Supporting Complex Care Teams

• Make the care plan “ever present”
• Support plan revision and expansion
• Support efficient information sharing

Challenges:

– Eliciting plans
– Inferring context in plan
– Reasoning about information sharing
Ongoing Work: 
GoalKeeper

**Attend school**

- Increase school attendance.
- Graph showing school attendance over dates.
- Pending Actions: Review material from last week on July 17, 2014.
- Dr. Sasse, Mr. Edu

**Gain weight**

- Gain weight, aim to reach 60 pounds.
- Graph showing weight gain over dates.
- Pending Actions: Schedule appointment with Dr. G on July 19, 2014.
- Dr. Sasse, Dr. O'Sullivan, John Doe, Jane Doe

**Seizure control**

- Understand seizure triggers and reduce number of seizures.
- Graph showing seizure frequency over dates.
- Pending Actions: Lab test on April 7, 2014.
- Dr. Sasse, Dr. House, John Doe, Jane Doe

**Recommendations:**
- Schedule appointment with Dr. G
- Update John Doe's weight

**Add a Goal**

- Goal name: 
- Type: Better/Same/Worse: Better
- Description: 
- Caregivers: Dr. Sasse, Dr. House, John Doe, Jane Doe, Mr. Edu
- Submit button
Ongoing Work: GoalKeeper

- **Attend school**
  - Increase school attendance.
  - Pending Actions:
    - Review material from last week on July 17, 2014
  - Dr. Seuss, Mr. Edu

- **Gain weight**
  - Gain weight, aim to reach 60 pounds.
  - Pending Actions:
    - Schedule appointment with GI on July 15, 2014
  - Dr. Seuss, Dr. O.K. John Doe, Jane Doe

- **Seizure control**
  - Understand seizure triggers and reduce number of seizures.
  - Pending Actions:
    - Lab test on July 17, 2014
    - Renew prescription on July 15, 2014
  - Dr. Seuss, Dr. House, John Doe, Jane Doe, Mr. Edu

**Recommendations:**
- Schedule appointment with GI
- Update Arts weight
Ongoing Work: Information Sharing Algorithms

What information to share?

When to share information?

Who to share information with?

How to present information?
**Ongoing Work: Supporting Collaborative Writing**

**Come check out our WiP poster today**

Deploying AI Methods to Support Collaborative Writing: a Preliminary Investigation

Gehrmann, Urke, Amir and Grosz, 2015
Conclusion

• Qualitative study of complex care teams
• Identifying FLECS teamwork characteristics
• Foundations for technology design from computational teamwork theories
• Ongoing work toward designing such systems…

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