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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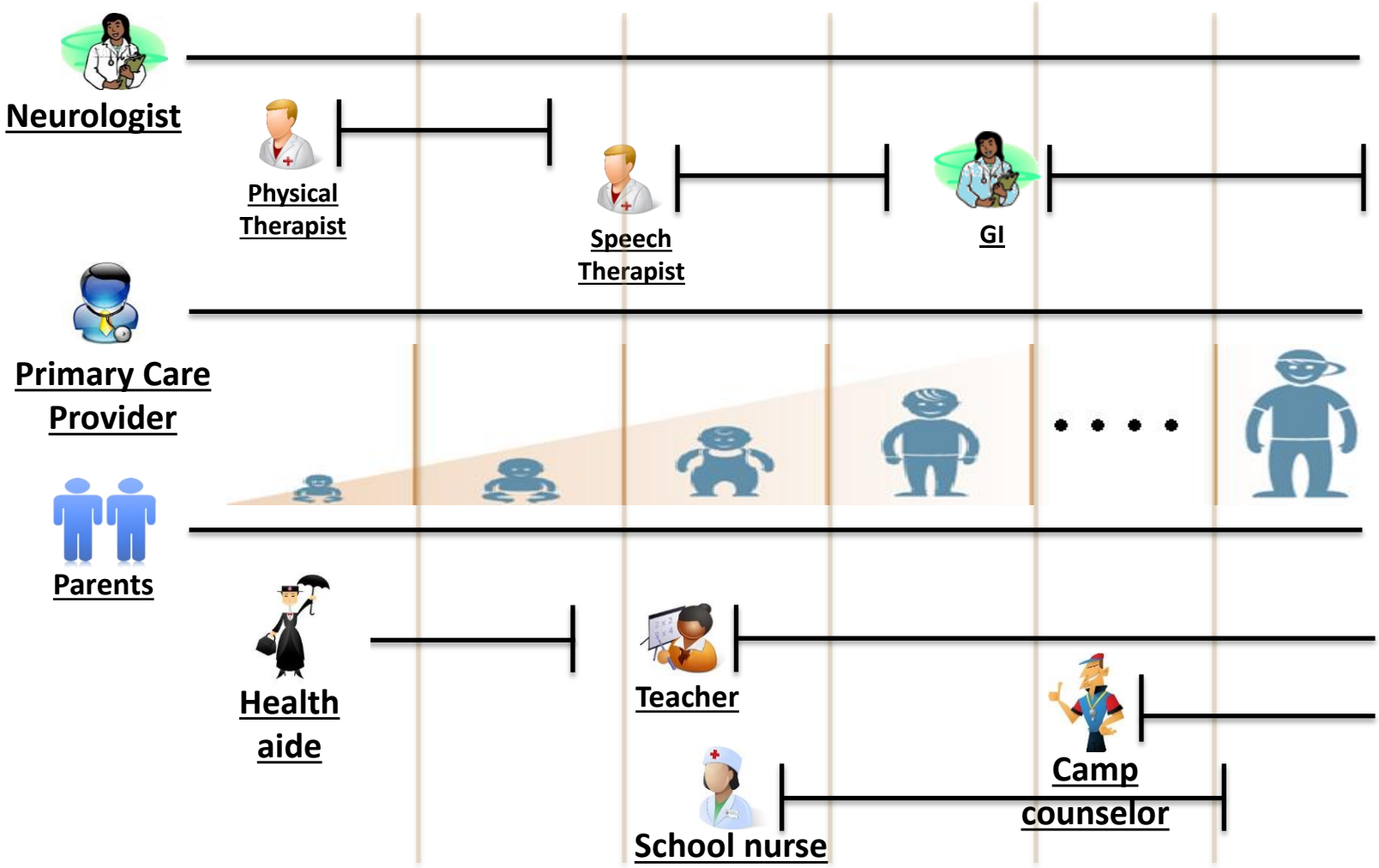
The Care for Children with Complex Chronic Conditions



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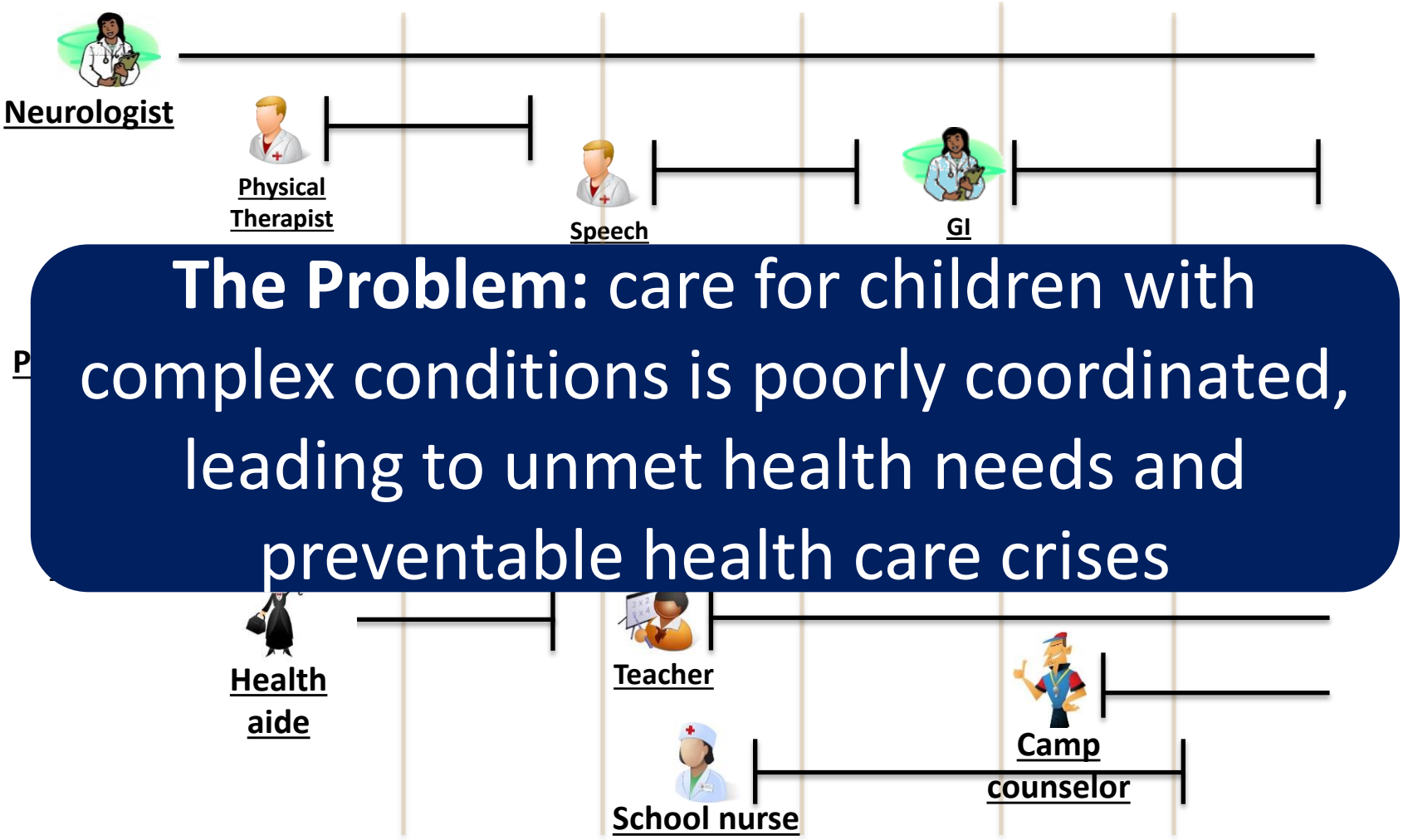

The Problem: care for children with complex conditions is poorly coordinated, leading to unmet health needs and preventable health care crises

Team-Based Care Plans for Improved Coordination (LPFCH, 2014)

Goals	Actions	Caregivers
Move to oral feeds	• Improve mouth muscle tone • Adjust formula for weight gain	PCP, GI, OT, nutritionist
Start daycare	• Minimize need for tube feeds • Assess therapy needs	Parents, PCP, nutritionist, home nurse
Go on family trip	• Arrange portable equipment • Arrange funding and transportation	Parents, PCP, PT, social worker

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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

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- Defining “FLECS” teamwork characteristics

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  - Care coordination challenges
  - Barriers to effective care plan implementation
- Defining “FLECS” teamwork characteristics
- Foundations for technology design based on a computational teamwork theory

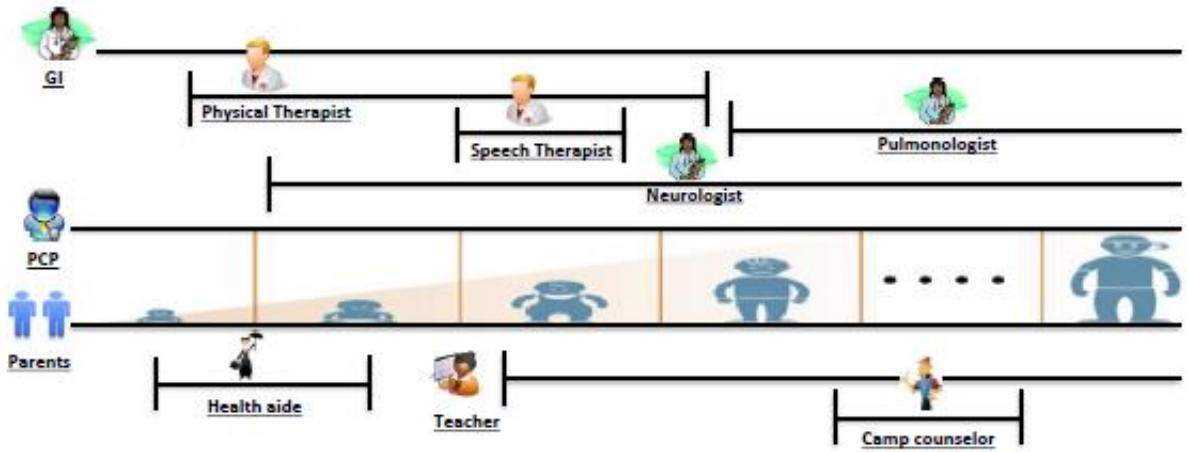
Study of Complex Care Teams

- 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, **C**ontinual 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 time a year*
- *Therapists: 1 to 3 times a week*

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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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- Principles for successful care plan use

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Team-Based Care Plans: Ideal vs. Reality

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

How can technology better support such complex teamwork?

Technology for Supporting Teamwork

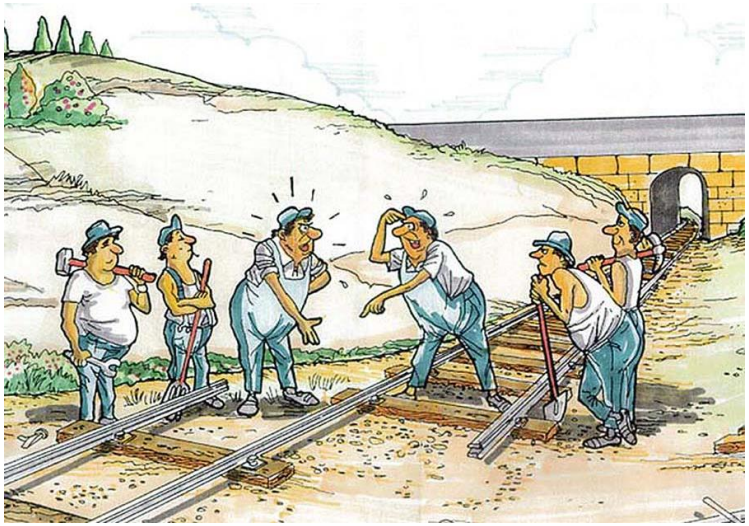
FLECS teamwork goes beyond prior work

- 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

Goals	Actions	Caregivers
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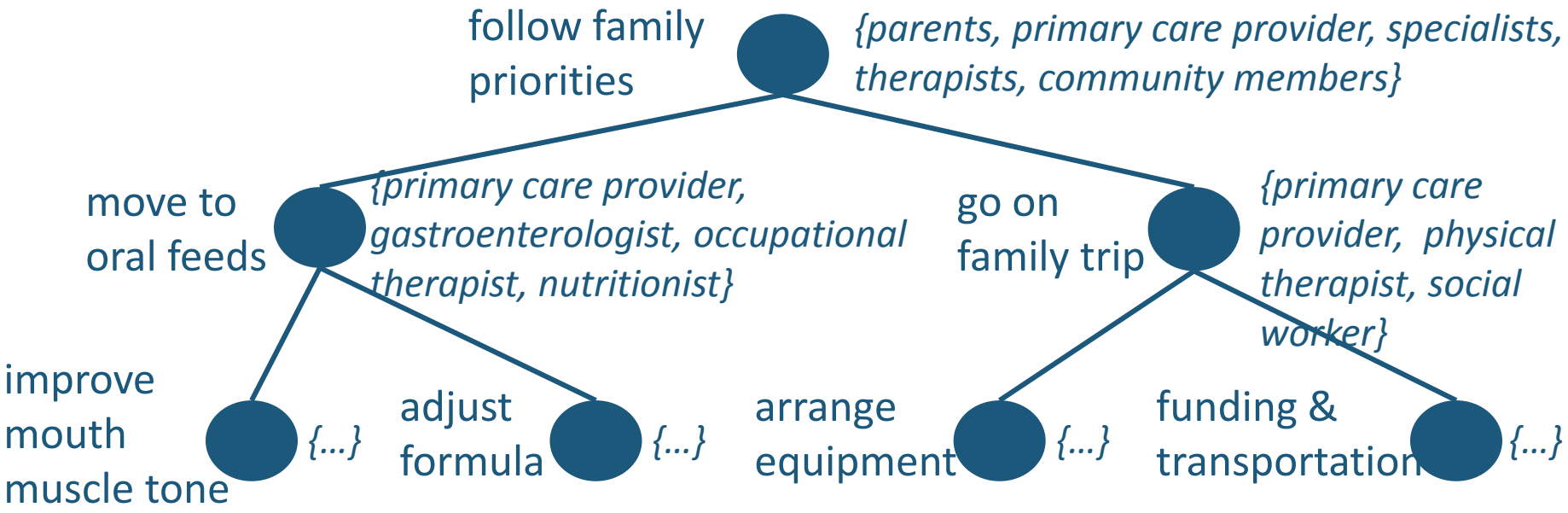
Go on family trip	• Arrange portable equipment • Arrange funding and transportation	Parents, PCP, PT, social worker



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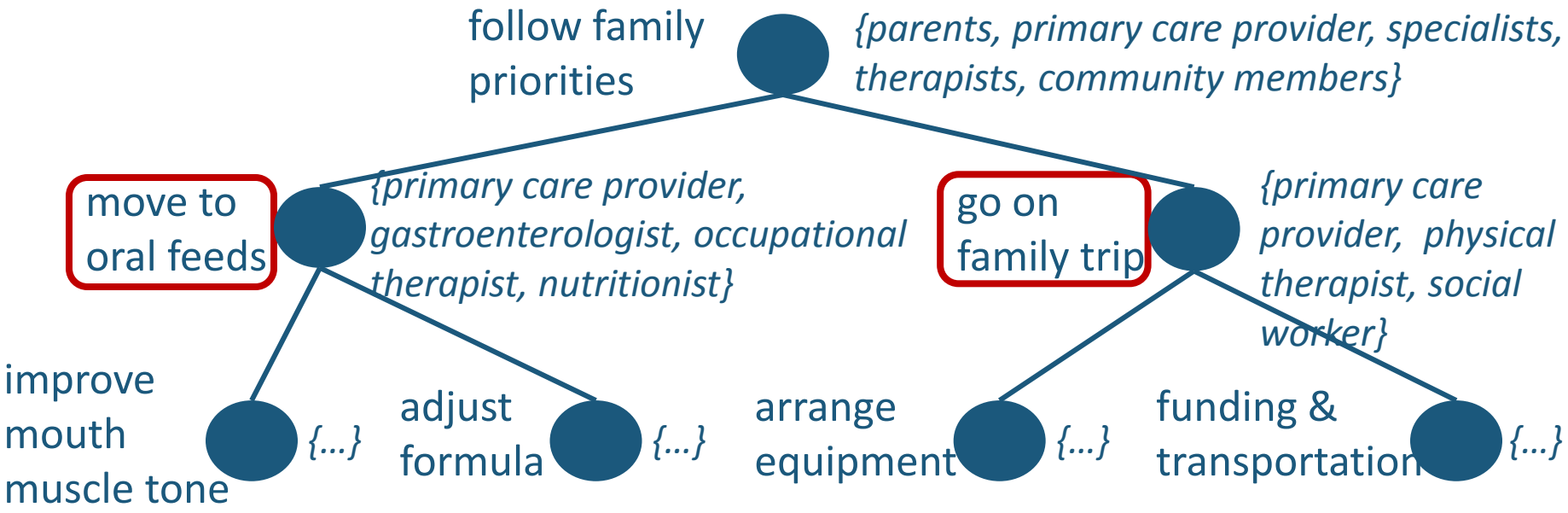

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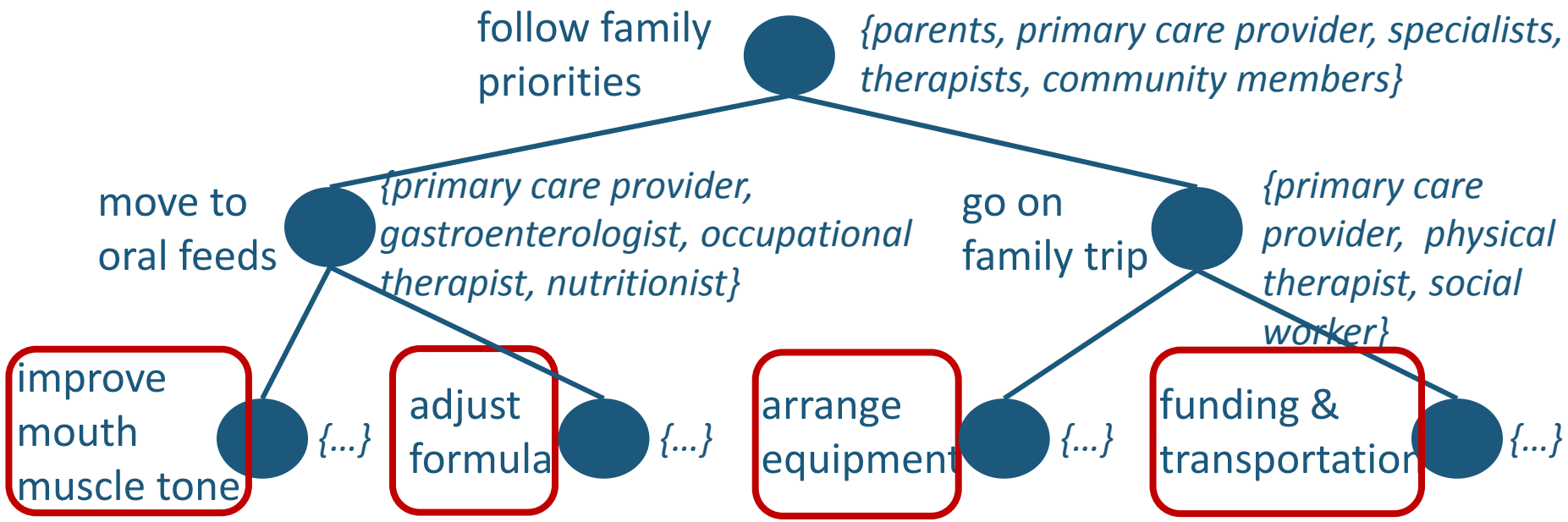

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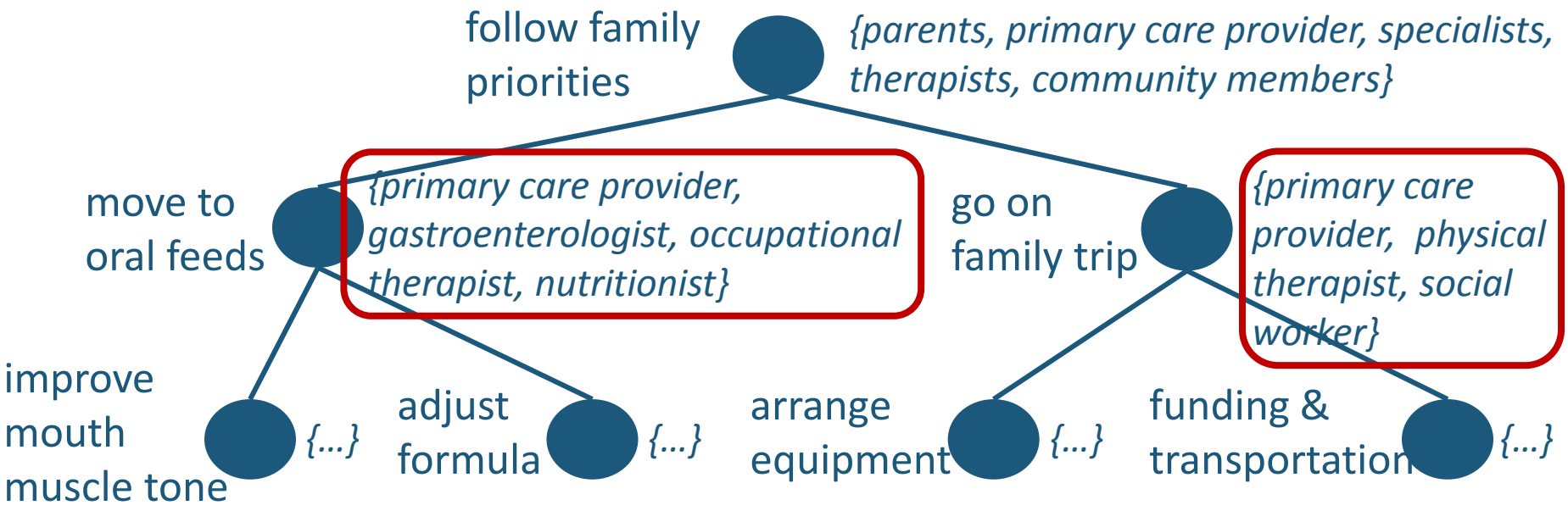
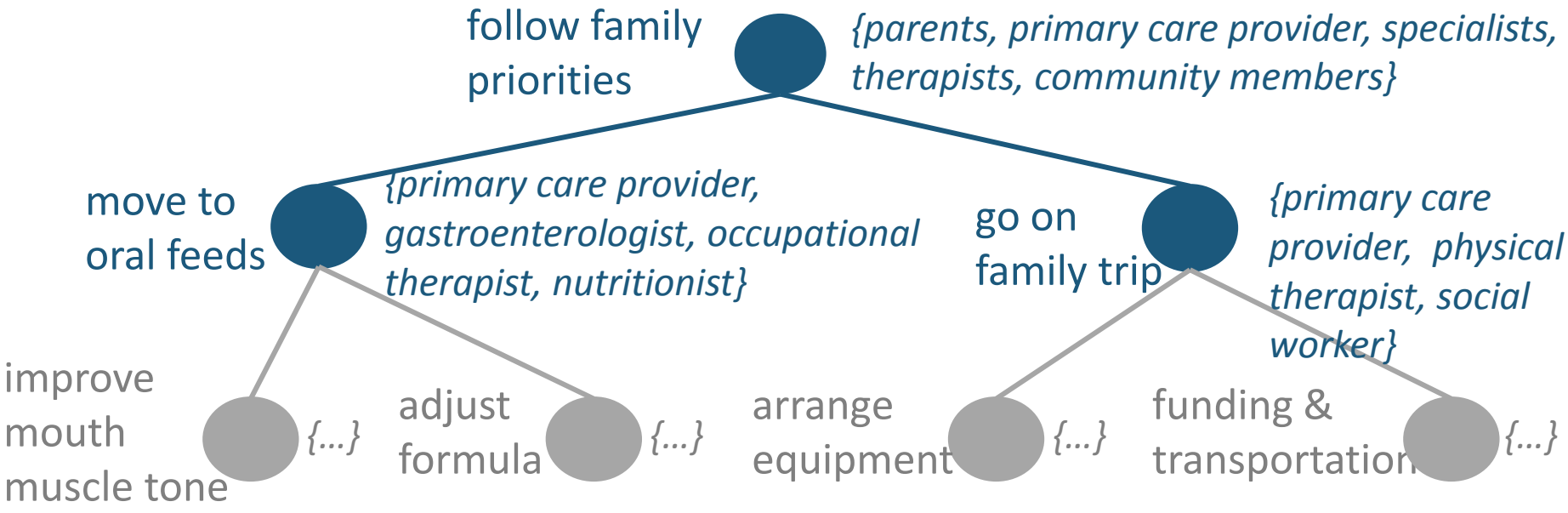


Agreement on High-Level Approach, Mutual Beliefs



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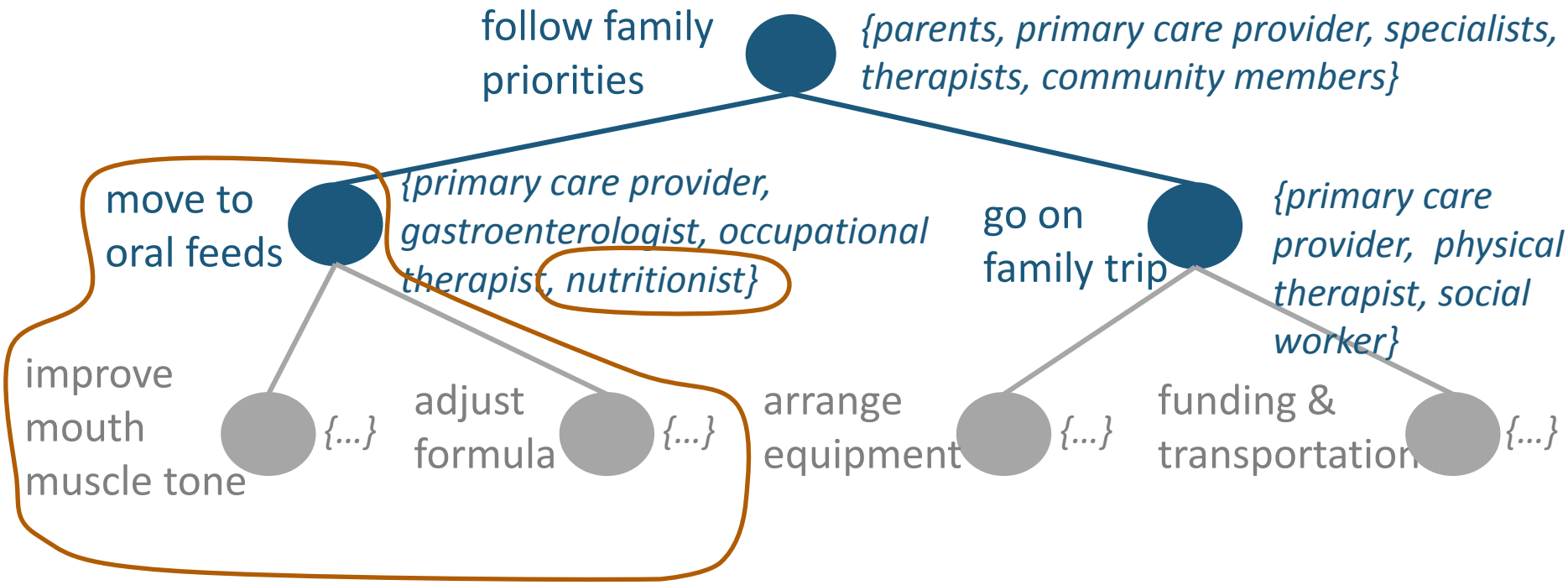

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Current Systems:
care plans are not integrated
no adaptation of plan information

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

Dynamically Evolving Plans

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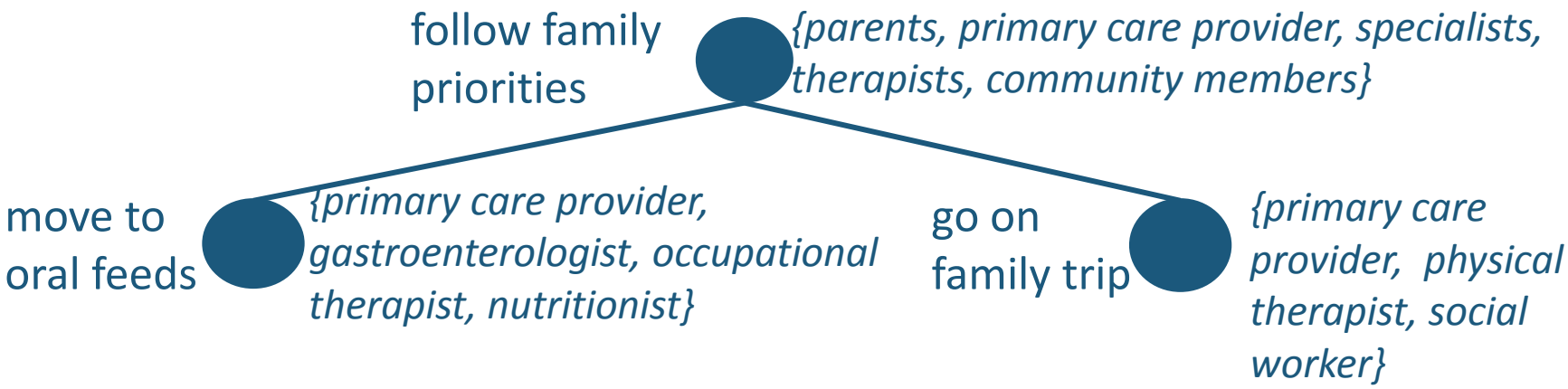

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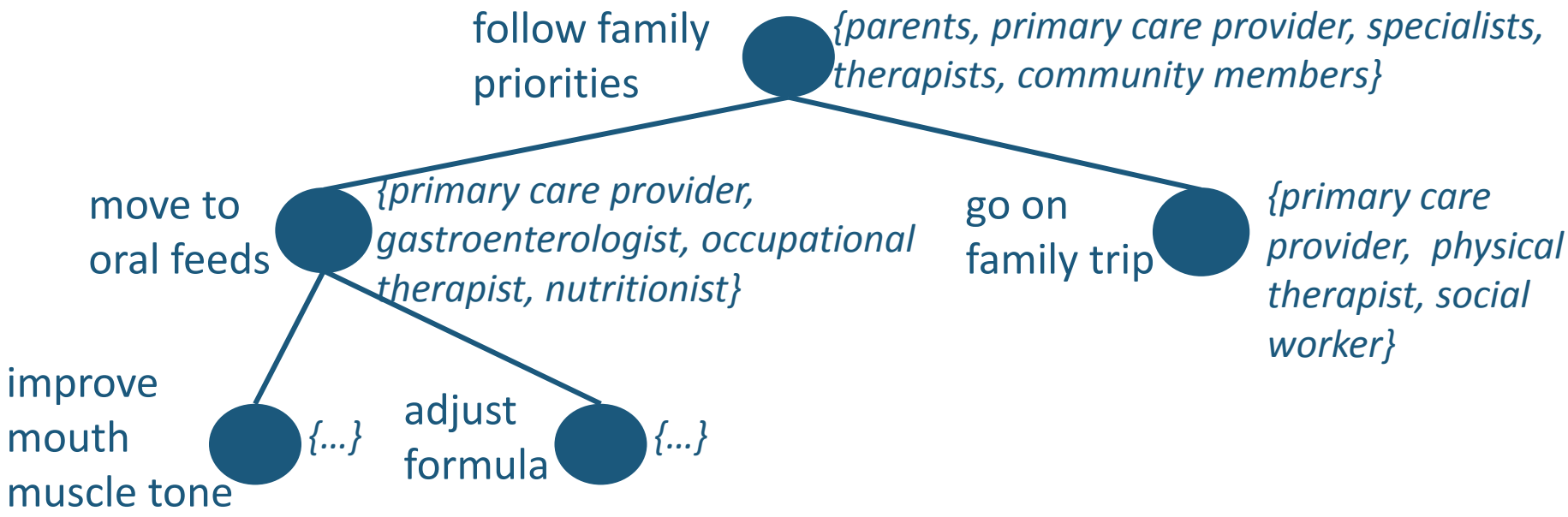

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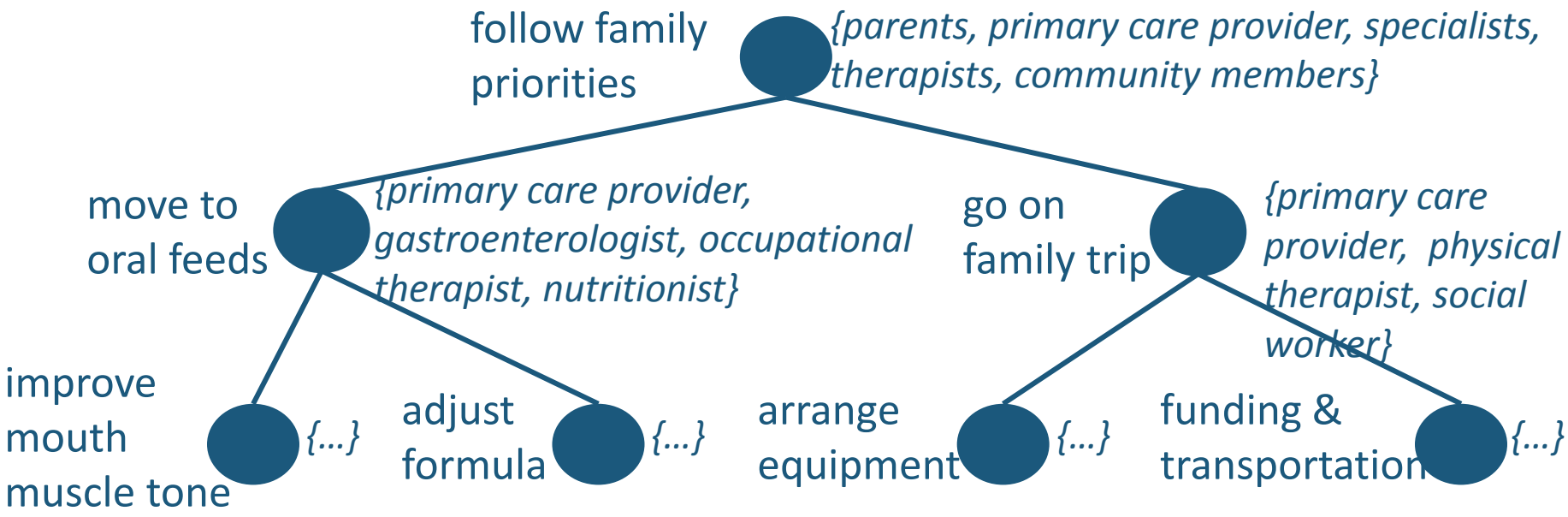

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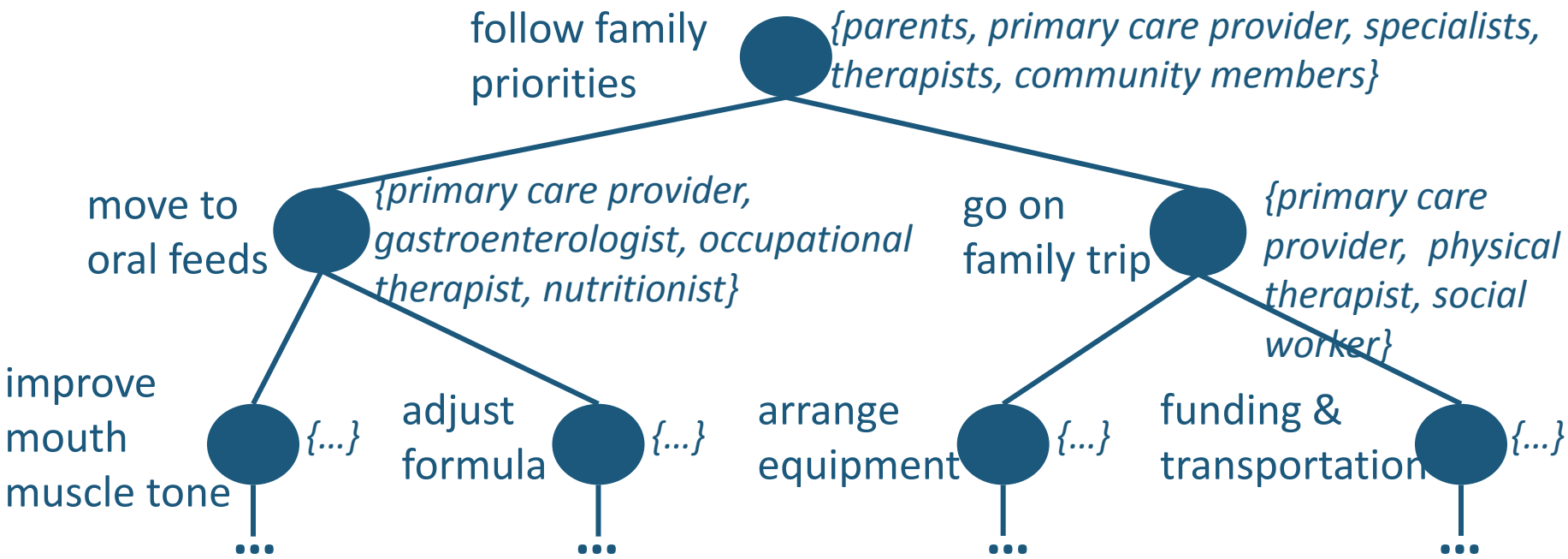

Dynamically Evolving Plans

Current Systems:
static, flat representation

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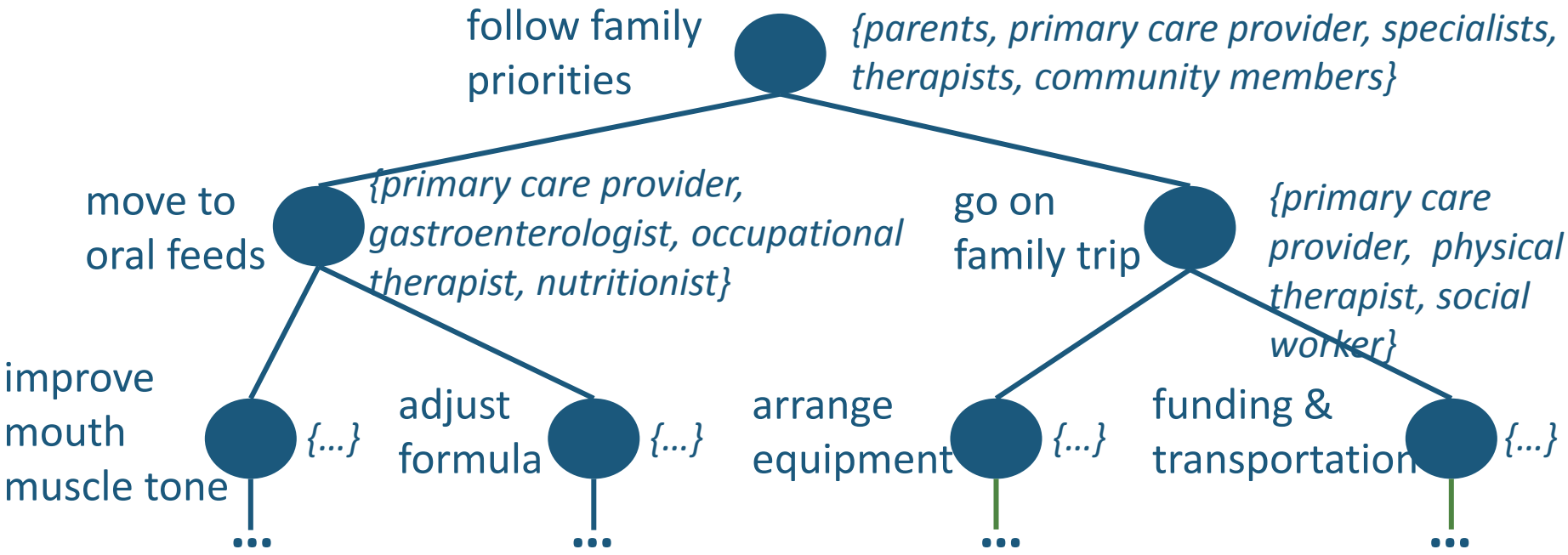
Opportunity for Technology Support:
dynamic plan structure
support revision and expansion

Communication and Coordination



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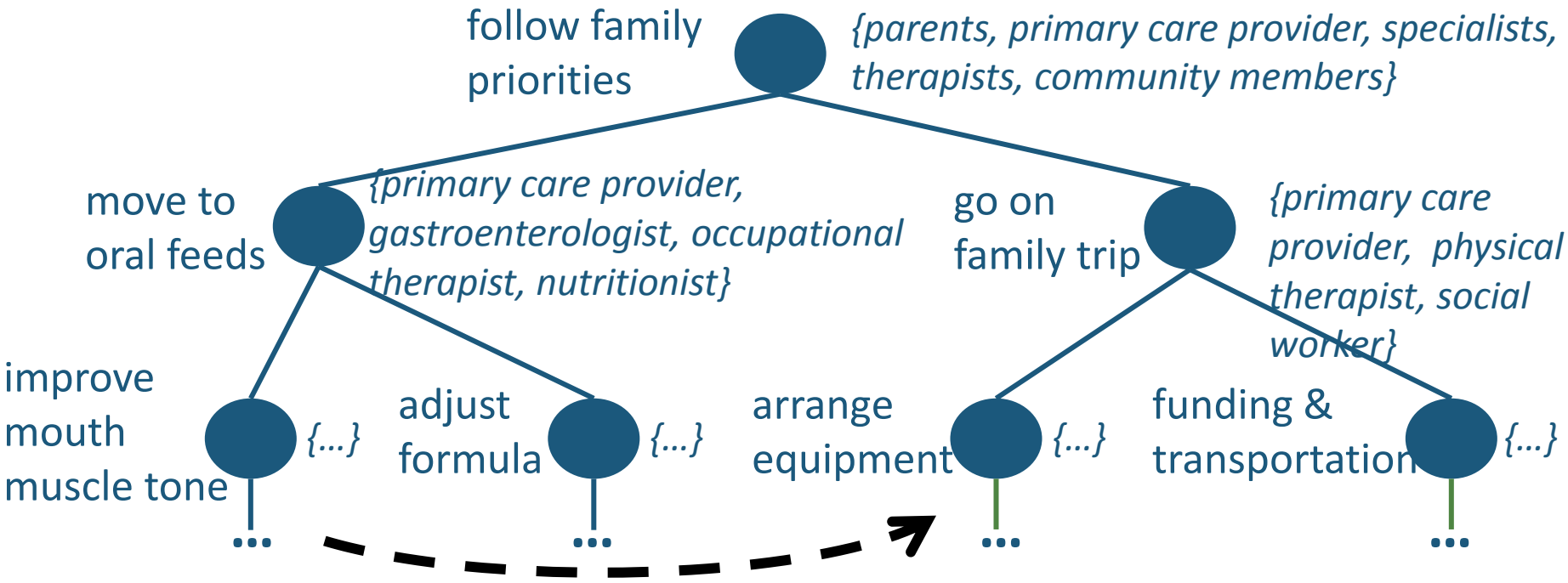

Communication and Coordination

Current Systems:
little organization and context
information overload

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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

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- Support efficient information sharing

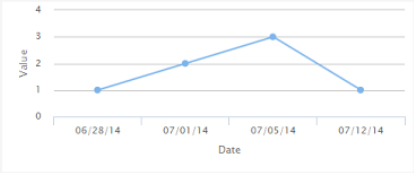
Challenges:

  - Eliciting plans
  - Inferring context in plan
  - Reasoning about information sharing

Ongoing Work: GoalKeeper

Goals | Actions | Profile | Contacts | Demo User

Attend school



Increase school attendance.

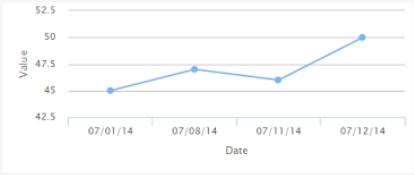
View this goal!

Dr. Seuss Mr. Edu

Pending Actions:

Review material from last week on July 17, 2014

Gain weight



Gain weight, aim to reach 60 pounds.

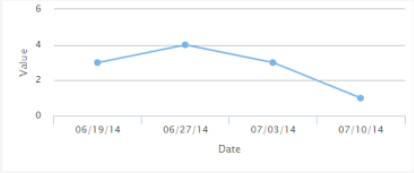
View this goal!

Dr. Seuss Dr. Dorian John Doe Jane Doe

Pending Actions:

Schedule appointment with GI on July 16, 2014

Seizure control



Understand seizure triggers and reduce number of seizures.

View this goal!

Dr. Seuss Dr. House John Doe

Pending Actions:

Lab test on July 17, 2014

Renew prescription on July 15, 2014

Recommendations:

- Schedule appointment with GI
- Update Bart's weight

Add a Goal

Goal name:

Type:

Better/Same/Worse

Description:

Caregivers:

- Dr. Seuss
- Dr. House
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- Jane Doe
- Mr. Edu

Submit

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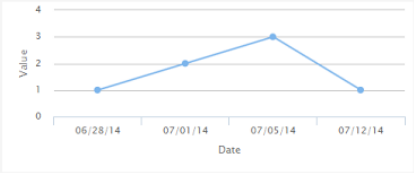

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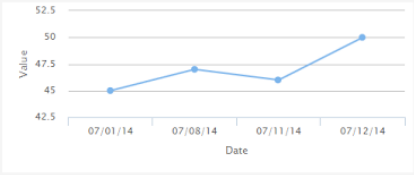

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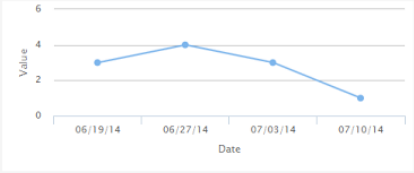

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Submit

Ongoing Work:
Information Sharing Algorithms

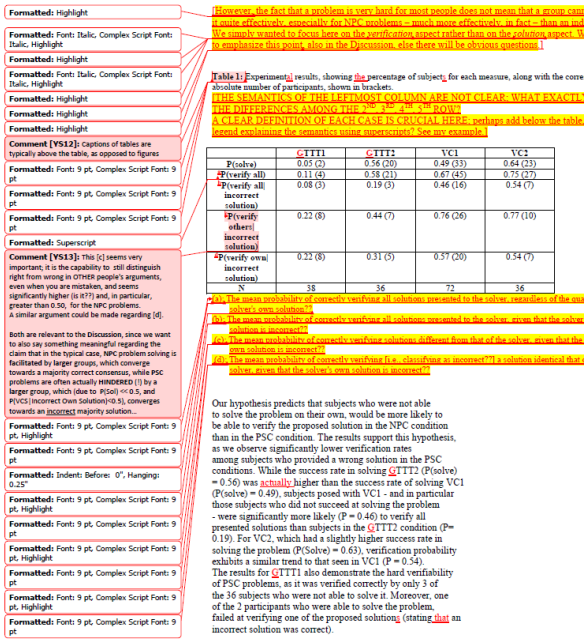
What information to share?

When to share information ?

Who to share information with?

How to present information?

Ongoing Work:
Supporting Collaborative Writing



We looked at two measures that indicate that a paragraph may need attention. The first checked whether the related paragraphs underwent at least one significant change within the next ten versions.
~~% indicating that a semantic discrepancy was introduced and required fixing.~~ ¶
The second measure tests whether the paragraphs continue to be edited together ten versions after the significant change, that is whether they change together (or remain unchanged together) more than half the time. This is a stronger indication than just undergoing at least one significant change.

On average, 1.6 pPairs of paragraphs related by edit history were found ~~on average 1.6 times~~ per revision of the text. A pair related by topic similarity were only found once every ten versions. Proximity relationships always exist for each paragraphs as there are always neighboring paragraphs.

With respect to the first measure, the relationships of edit history and topic similarity are much more predictive of a future significant edit than proximity, as shown in Table~\ref{table:futureEdits}. They are also significantly more predictive than random sample controls. ~~For controls, we~~ we compare with the original paragraph as well as a random sample of any ten consecutive versions within Wikipedia article histories.

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\textbf{Relationship}          & \textbf{Percentage of times there exists
at least one significant change} \\ \hline
Edit  History                                  &  81\%
\\ \hline

Proximity                                      &  24\%
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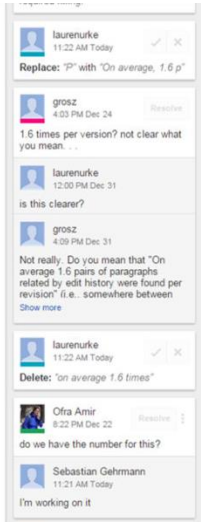

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Conclusion

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- Identifying FLECS teamwork characteristics
- Foundations for technology design from computational teamwork theories
- Ongoing work toward designing such systems…

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