Nursing Insights From CaringBridge Notes

2018 Nursing Knowledge: Big Data Science Conference
Pre-Conference Track 2: Social Media Analytics and Mobile Technology

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Acknowledgments

- CaringBridge funding for the study: Understanding the impact of social technology on wellbeing, altruism & health outcomes (Kreitzer, M. J., PI).

    - Center for Spirituality and Healing Team
    - College of Computer Science and Engineering Team
    - Omaha System Partnership-Center for Nursing Informatics

Objectives

- Describe CaringBridge, a compassionate technology social media platform

- Describe ontologically-based text mining

- Discuss methodological approaches for use in social media text mining

- Identify applications and implications for social media text mining methods

CaringBridge

CaringBridge.org

- Nonprofit social network
  - Facilitate communication with friends and family
  - Support for loved ones during a health journey
- Free personal website
- Place for healing and comfort
  - 740,000 web sites
  - 235 countries

Sona Mehring (founder) with JoAnn Hardegger and Darrin Swanson holding a photo of their daughter Brighid, the baby who inspired CaringBridge in 1997. (Photo: May 2011. https://www.caringbridge.org/about-us)

UMN-CaringBridge Collaboration

- Liwanag Q. Ojala, Chief Executive Officer, CaringBridge
- Mary Jo Kreitzer, Director, Bakken Center for Spirituality and Healing, University of Minnesota
  - Karen A. Monsen, School of Nursing
  - Arindam Banerjee, Computer Science and Engineering
  - Lana Yarosh, Computer Science and Engineering

The Ontology Question Guiding the Text-mining Approach

- *"What kinds of things exist or can exist in the world, and what manner of relations can those things have to each other?"*
  http://semanticweb.org/wiki/Ontology
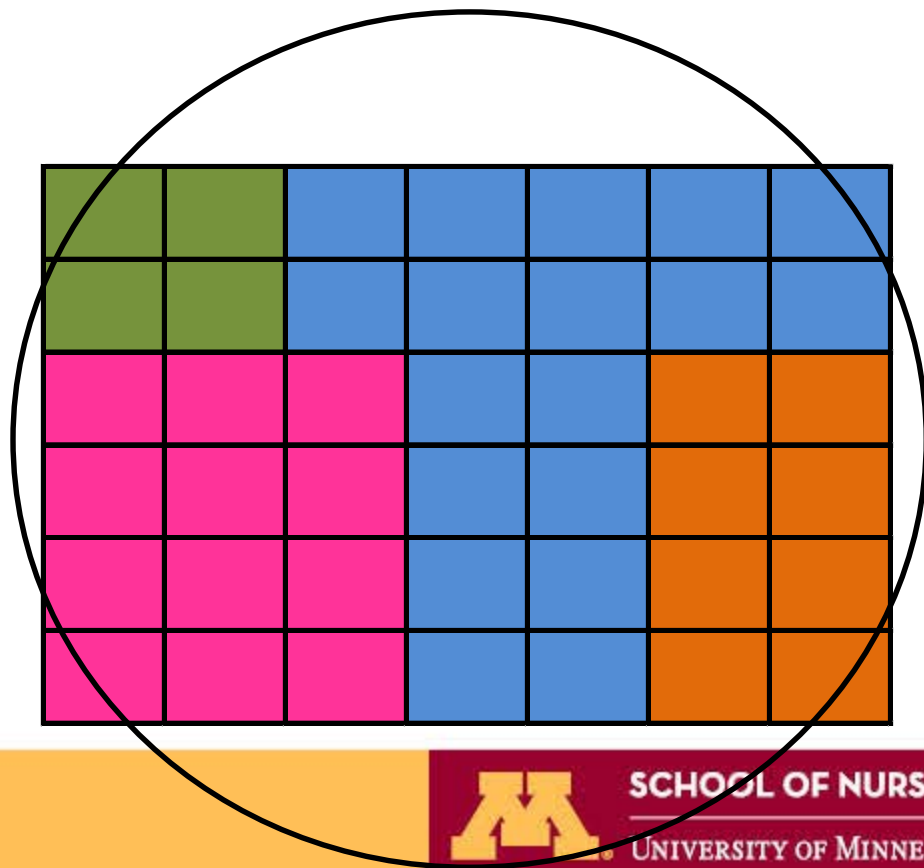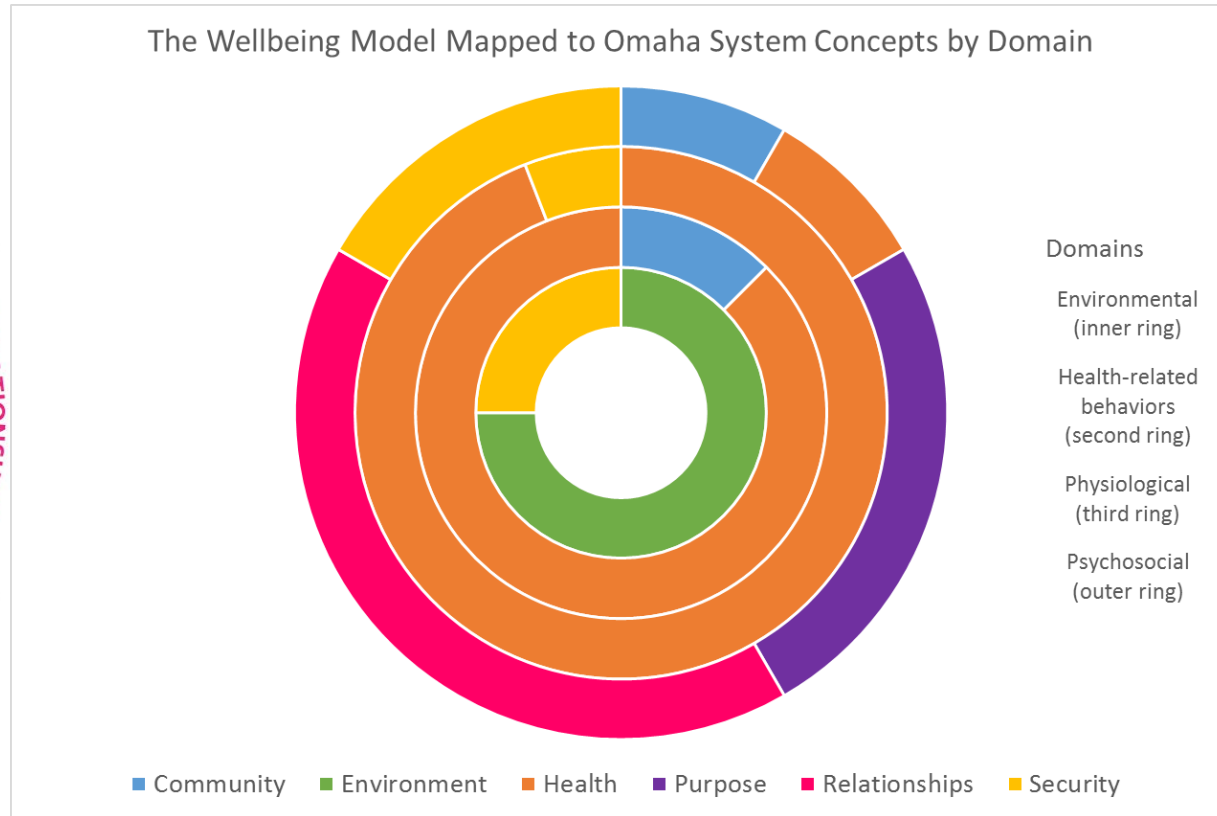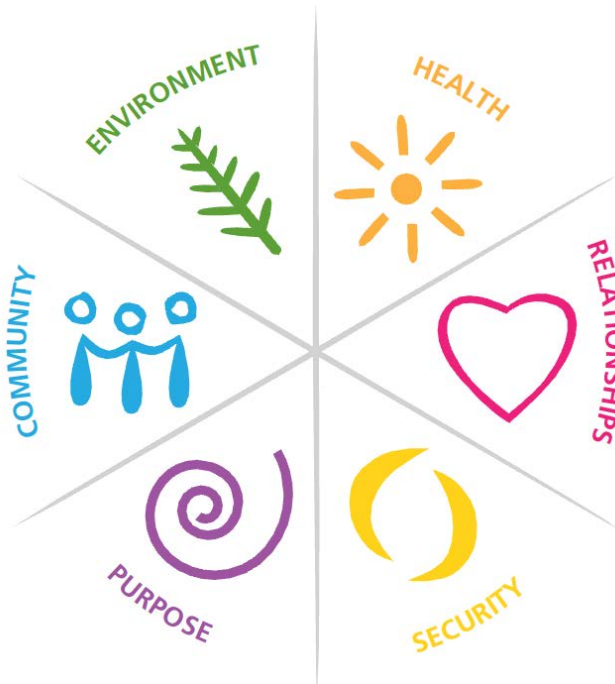
The Omaha System (Martin, 2005)
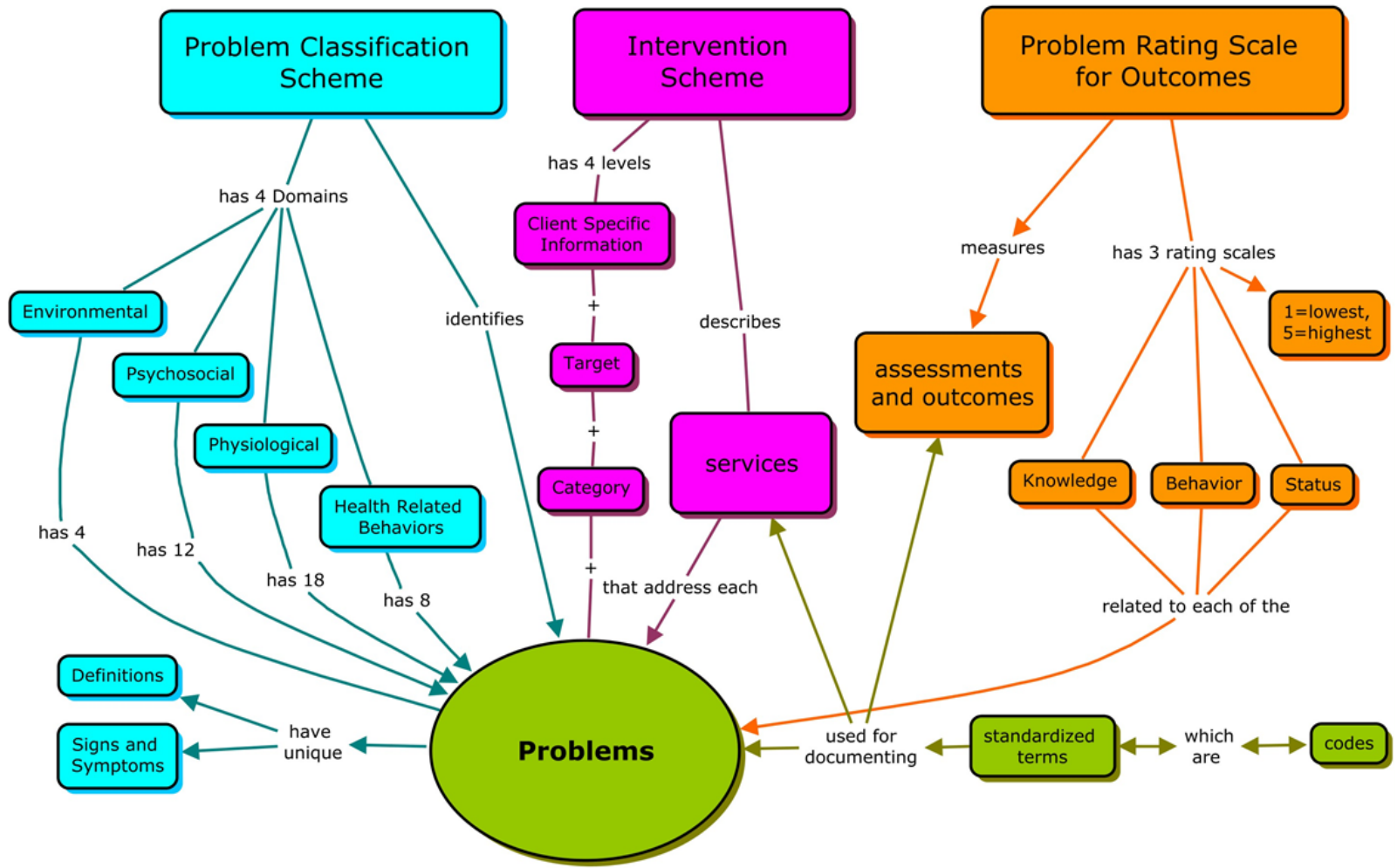
42 Neutral Concepts

Describe all of health and health care

Called "Problems" but may refer to strengths as well

Comprehensive Whole

The Wellbeing Model Mapped to Omaha System Concepts by Domain

Domains

Environmental (inner ring)

Health-related behaviors (second ring)

Physiological (third ring)

Psychosocial (outer ring)

■ Community ■ Environment ■ Health ■ Purpose ■ Relationships ■ Security

MJ **Kreitzer** & M. **Koithan** (Eds.), Integrative nursing. Cary, NC: Oxford University Press.

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Problem Classification Scheme

- Describes defined health concepts in four domains
  - Environmental (4 problems)
  - Psychosocial (12 problems)
  - Physiological (18 problems)
  - Health-related Behaviors (8 problems)

- Every problem has a definition and a unique list of signs/symptoms
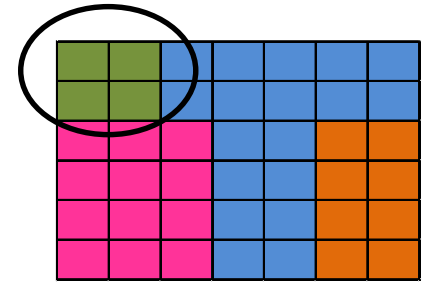 - See http://omahasystem.org/problemclassificationscheme.html
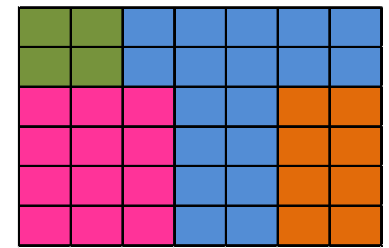
Environmental Domain

Income

Sanitation

Residence

Neighborhood/workplace safety

Psychosocial Domain

Communication with community resources
Social contact
Role change
Interpersonal relationship
Spirituality
Grief
Mental health
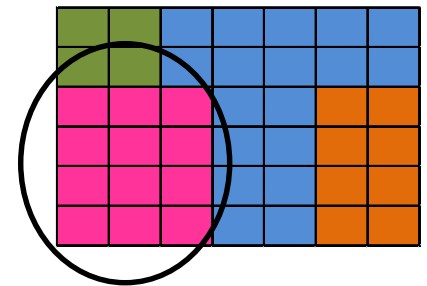Sexuality
Caretaking/parenting
Neglect
Abuse
Growth and development

Physiological Domain
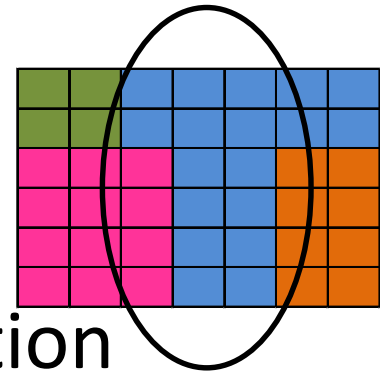
Hearing
Vision
Speech and language
Oral health
Cognition
Pain
Consciousness
Skin
Neuro-musculo-skeletal function

Respiration
Circulation
Digestion-hydration
Bowel function
Urinary function
Reproductive function
Pregnancy
Postpartum
Communicable/infectious condition

Health-related Behaviors Domain

Nutrition
Sleep and rest patterns
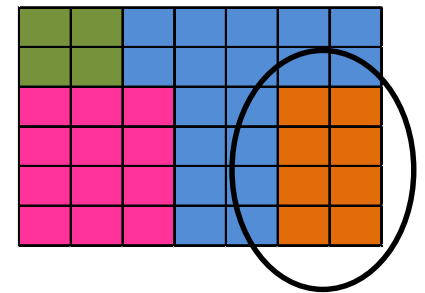Physical activity
Personal care
Substance use
Family planning
Health care supervision
Medication regimen

Specific Aims

1. To develop ontology-based text mining methods for application in a CaringBridge social media corpus

2. To examine the use of the Omaha System as a basis for understanding whole-person health/wellbeing in CaringBridge journals

3. To describe CaringBridge journal content from a whole-person perspective

Methods

- Sample consisted of free text from 13,757,900 CaringBridge journal entries

- The text dataset was prepared by removing stop words and html text using standard NLP procedures by Giaquinto, Banerjee, and team

- Word counts of the 42 Omaha System problem concepts were obtained using shell scripts and python programming on Minnesota Supercomputing Institute High Performance Computing systems in four steps

Text Mining Approach

- Step 1: Problem concept stems
- Step 2: Combining problem concept stems
- Step 3: Adding S/sx stems
- Step 4: Adding synonyms and related words

Sleep and rest patterns

- Periods of suspended motor and sensory activity and periods of inactivity, repose, or mental calm
  - Sleep/rest pattern disrupts family
  - Frequently wakes during night
  - Sleepwalking
  - Insomnia
  - Nightmares
  - Insufficient sleep/rest for age/physical condition
  - Sleep apnea
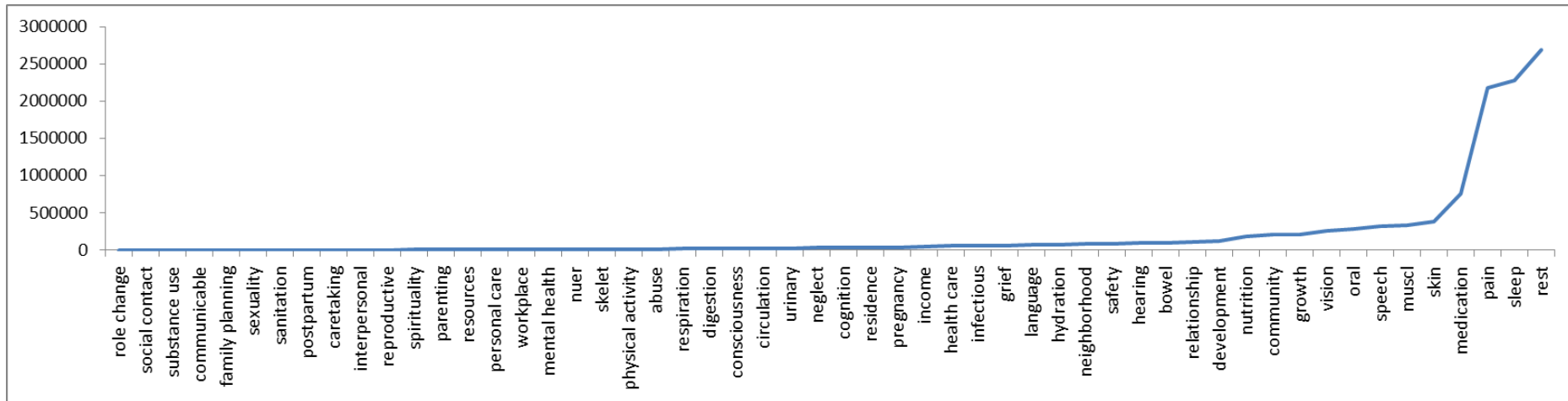 - Snoring

Sleep and Rest Patterns
Stems, S/sx, Synonyms

- Sleep
- Rest
  - awake during night
  - sleepwalk
  - insomnia
  - Nightmare
  - snoring

- repose
- snore
- awake at night
- awake all night
- up all night
- nap
- doze
- shut eye
- shuteye

Results
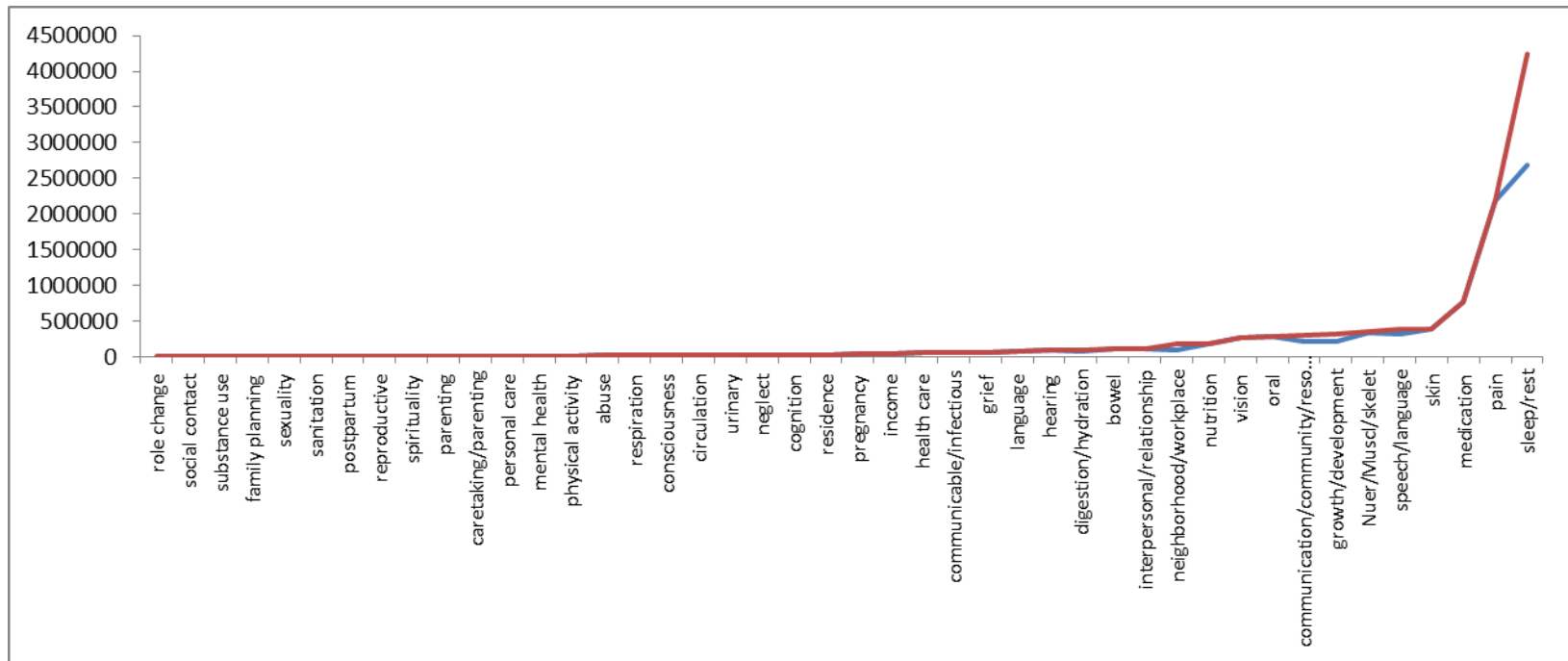# Step 1: Problem concept stems

- All 55 terms and stems were present

- Range from 336 (Role change) - 2,685,494 (Rest)

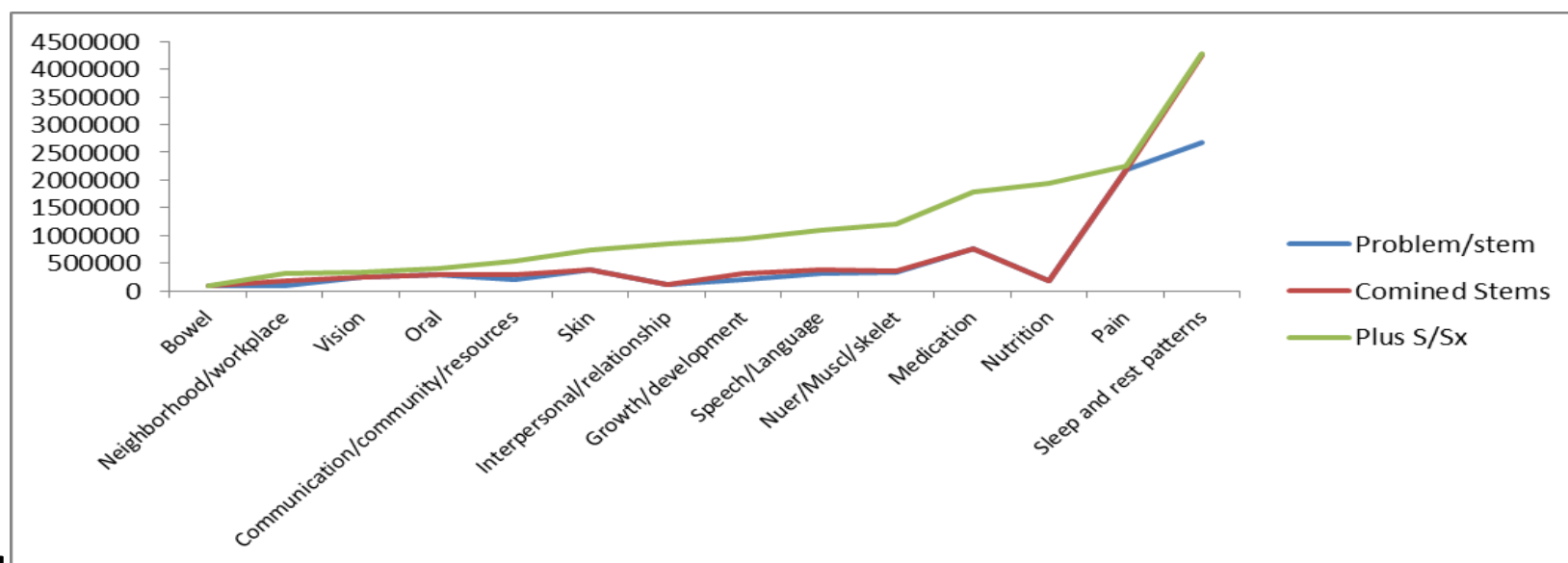# Step 2: Combine problem concepts from terms and stems

- Showing 42 concepts

- Maximum = Sleep/rest (>4M)

Step 3: Adding signs/symptoms
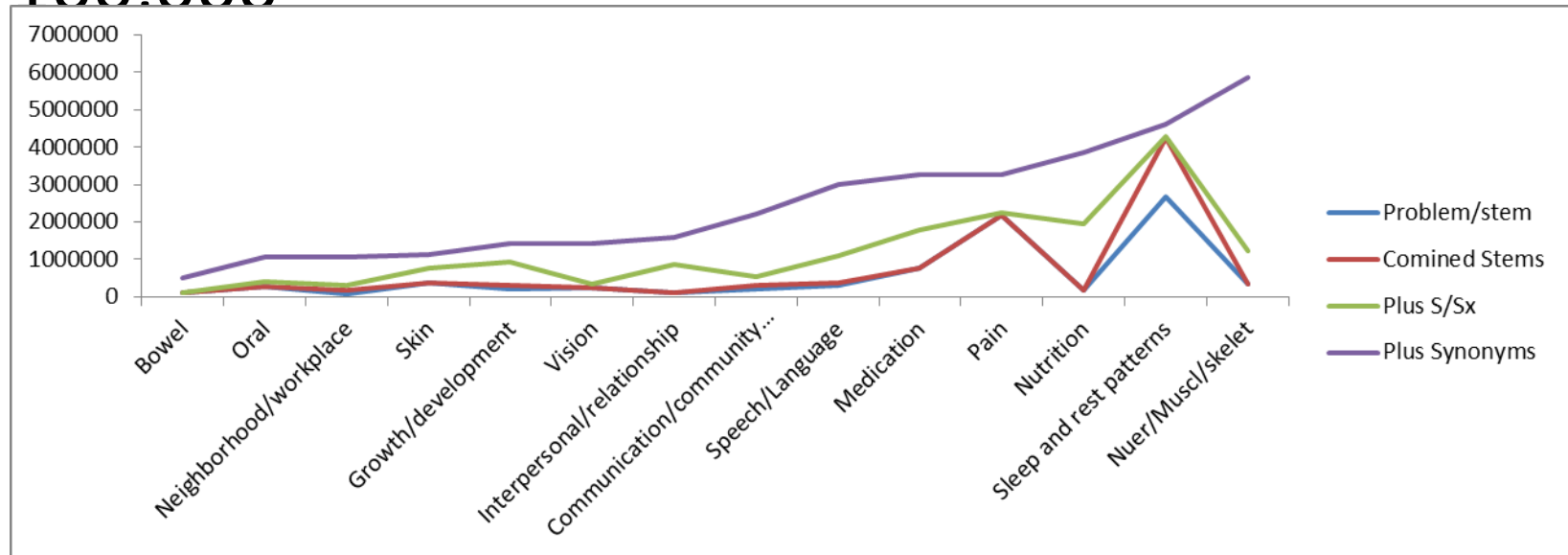
- showing problem terms and stems with N > 100,000

- Increases ranged from 2.5% to 957.3%
- Maxiumum = 4.5M

Step 4: Adding related words

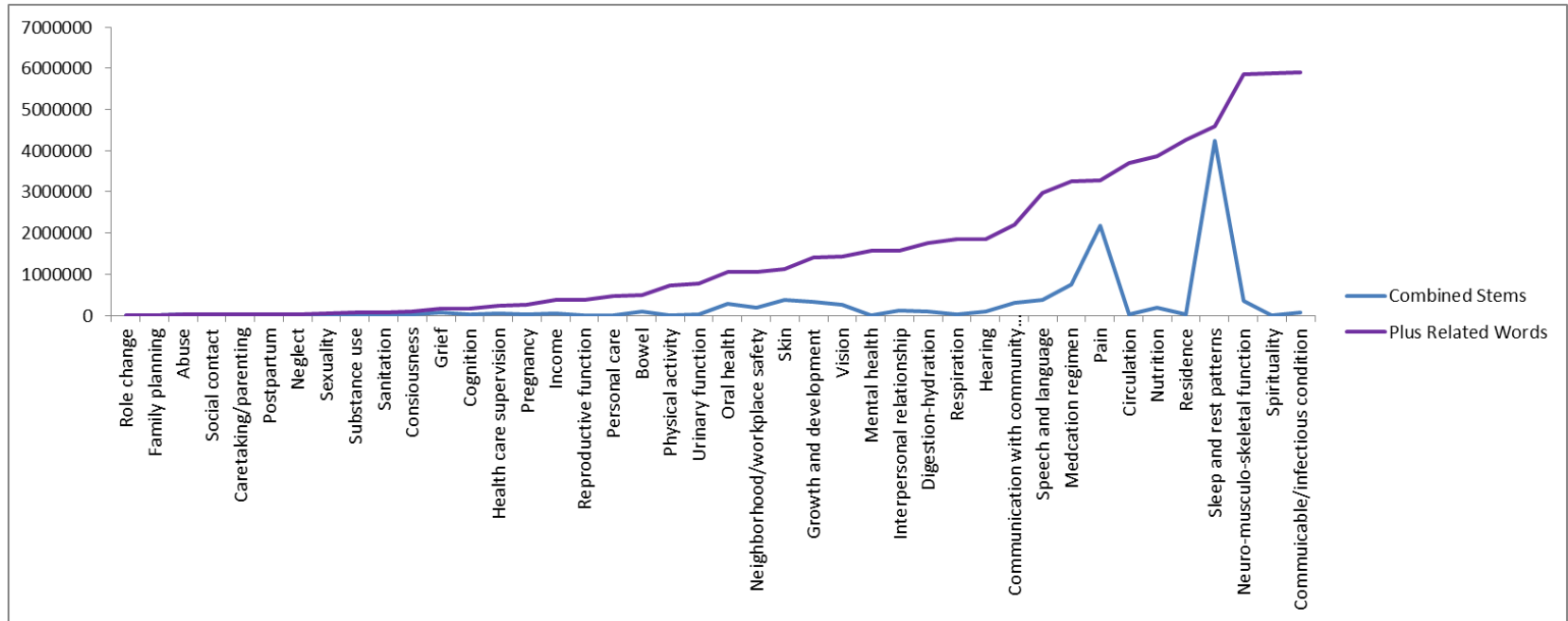- showing problem terms and stems with N > 100,000

- Increases ranged from 7.4% to 381.2%
- Maximum = 6M

Step 4: Adding related words

- showing all problem concepts

- Increases ranged from 0.01% (Abuse) % to 1548.5% (Spirituality)

- Maximum = 6M

Preliminary Validation

- "Things looked fine far as the skin [*Skin*] color, oozing, swelling, and blisters, it's all there, just in the right amounts, nothing to worry about."

- "They will run some tests to see if parainfluenza [*Communicable/infectious condition*] is still cause of his cough [*Respiration*]."

- "He does not walk unless necessary like getting to car so he's quite weak [*Neuro-musculo-skeletal function*]."

Other Important Observations

- Some CaringBridge authors express extreme emotions

```
aaaaaaaaaaaaaaaaaaaahhhhh
aaaaaaaaaaaaaaaaaahhhbye
aaaaaaaaaaaaaaaaaagony
aaaaaaaaaaaaaaaagggggggggggh
aaaaaaaaaaaaaaaada
aaaaaaaaaaaaaaaaaaaarrrrrrrrrrrrrggggggggggggggggghhhhhhhh
aaaaaaaaaaaaaaaaaaarrrrrrrrrrrrggggggggggggghhhh
aaaaaaaaaaaaaaaaaaarrrggggggg
aaaaaaaaaaaaaaaaaaannnnnnnnny
aaaaaaaaaaaaaaaaaaalllllllllllllllllll
```

Possible Intervention Topics

- Many people talk about
  - Sleep and rest
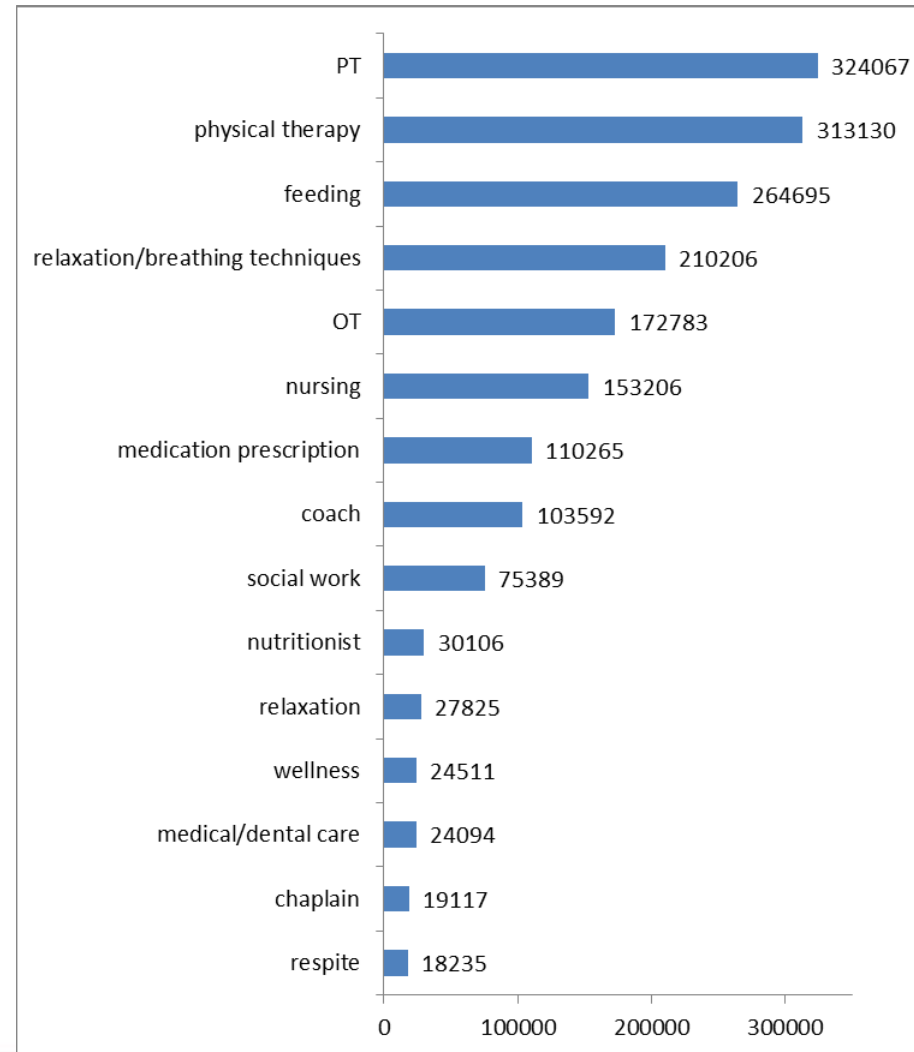 - Pain
  - Nutrition
  - Medications

Intervention Terms: Categories

- Many people talk about
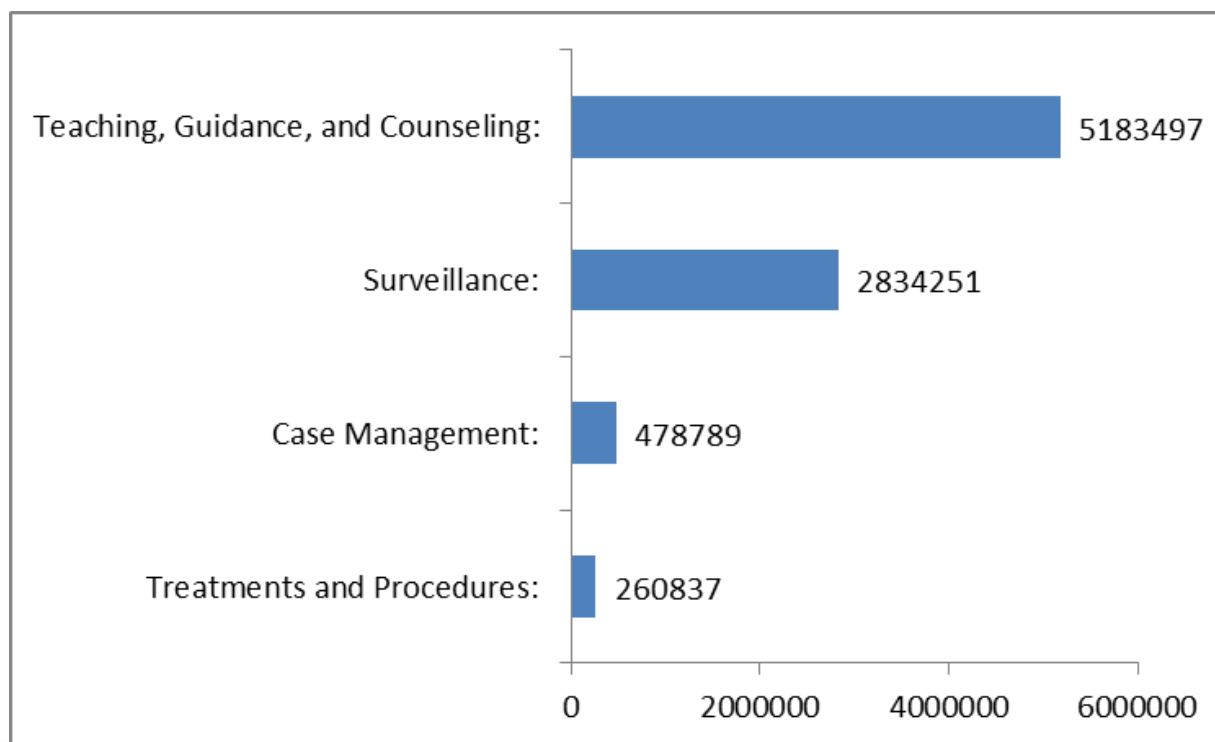
Intervention Terms: Target

- Many people talk about
  - PT
  - Feeding
  - Breathing techniques
  - OT
  - Nursing
  - Prescription
  - Coach
  - Social work

Term	Value
PT	324067
physical therapy	313130
feeding	264695
relaxation/breathing techniques	210206
OT	172783
nursing	153206
medication prescription	110265
coach	103592
social work	75389
nutritionist	30106
relaxation	27825
wellness	24511
medical/dental care	24094
chaplain	19117
respite	18235

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Limitations

- Challenges of interpretation:
  - Concepts may be positive or negative
  - Idiomatic bias: need to take words at face value, and not include some words: e.g. "See" could relate to vision or be used in many other idiomatic expressions
  - Semantic equivalence: many ways to say the same thing, difficult to capture all synonyms
  - Overlap: Despite the Omaha System's taxonomic structure, there may be areas of overlap in some concepts expressed in natural language

Next Steps

- Validate meaning and concept saturation through review of randomly selected journals

- Automate model selection for each concept

- Tag each journal with problem concepts

- Cluster authors to identify meaningful subgroups

- Apply sentiment analysis techniques to understand whether concepts are positive or negative

- Identify intervention needs and outcomes

Model Selection Tool

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Preliminary Findings from Use of Model Selection Tool

- TBD

Applications for Use in Other Social Media Platforms

- Word2vec technique will identify words in any corpus associated with the standardized words

- Specialized vocabularies may need to be built for each platform

- Model selection tools can help identify best models to be used by concept, with each corpus and platform

Spinning Words into Data

- Implications for our future work
  - We hope to continue the process of tagging journals with 42 concepts, 4 intervention categories, and 75 intervention targets in order to apply typical clustering and analytics methods to text data as we would to quantitative data
  - These methods should be tested with other datasets from diverse platforms and populations

Conclusions

- The Omaha System text mining approach revealed differential representation of CaringBridge content from a whole-person perspective

- Further research is needed to extend this approach to inform important clinical questions and intervention opportunities

Thank you!

- Questions?
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