

Hedging their Mets

The Use of Uncertainty Terms in Clinical Documents and its Potential Implications when Sharing the Documents with Patients

David Hanauer

On behalf of

Yang Liu, Qiaozhu Mei, Frank Manion, Ulysses Balis, & Kai Zheng



University of Michigan





Hedging their Bets

Mets is shorthand for metastases

Uncertainties Pervade Medicine



**Clinicians often
document uncertainty
in the medical record**



These are known as hedge phrases

**“any term or phrase that is ambiguous
or lacks clear precision”**

Hedging can take multiple forms

Probability

- ✓ likely
- ✓ probable
- ✓ possible

Frequency

- ✓ often
- ✓ occasionally
- ✓ sometimes

Quantity

- ✓ many
- ✓ few
- ✓ some

OpenNotes Project



Allow patients and families to read their clinical notes

This can increase transparency, but may also lead to confusion or loss of trust



Examples from clinical notes

Possible but **inconclusive** source of melena.

He had normal range of affect and with
perhaps some mild anxiety.



Study Objectives

- (1) to review the literature to compile a **comprehensive list** of hedge phrases
- (2) to quantify the **frequency** and **distribution** of hedge phrases in clinical documentation
- (3) to determine the **proximity** of hedge phrases to various **clinical concepts** including **diagnoses** and **symptoms**

Methods: Literature Review

31 papers identified

313 distinct hedge phrases identified

+

28 additional phrases were added

341 total hedge phrases



Methods: Empirical Site

The University of Michigan Health System (UMHS), a 930-bed quaternary academic medical center that has over 44,000 inpatient admissions and 1.7 million ambulatory visits annually.



Methods: Document Corpora

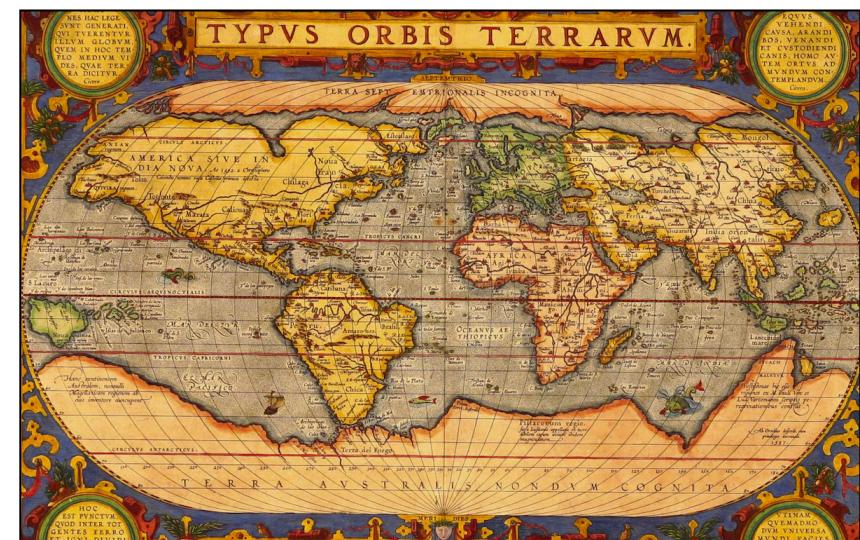
- ✓ A random sample of 100,000 notes from hematology/oncology patients in UMHS' EHR system.
- ✓ All documents were de-identified using the MITRE Identification Scrubber Toolkit (MIST).

Methods: Frequencies

- ✓ 100,000 documents split into 3.86 million sentences
- ✓ Sentences with ≥ 1 hedge phrase were identified with regular expressions
- ✓ The frequency of hedge phrases among document types was determined

Methods: Concept Identification

- ✓ NLM MetaMap 2011 used to identify clinical concepts and UMLS semantic types
- ✓ Hedge phrases were associated with each clinical concept if within a window size of 4.



Results



Of the 341 hedge phrases

Thirty-three appeared in 4 or more papers in the literature

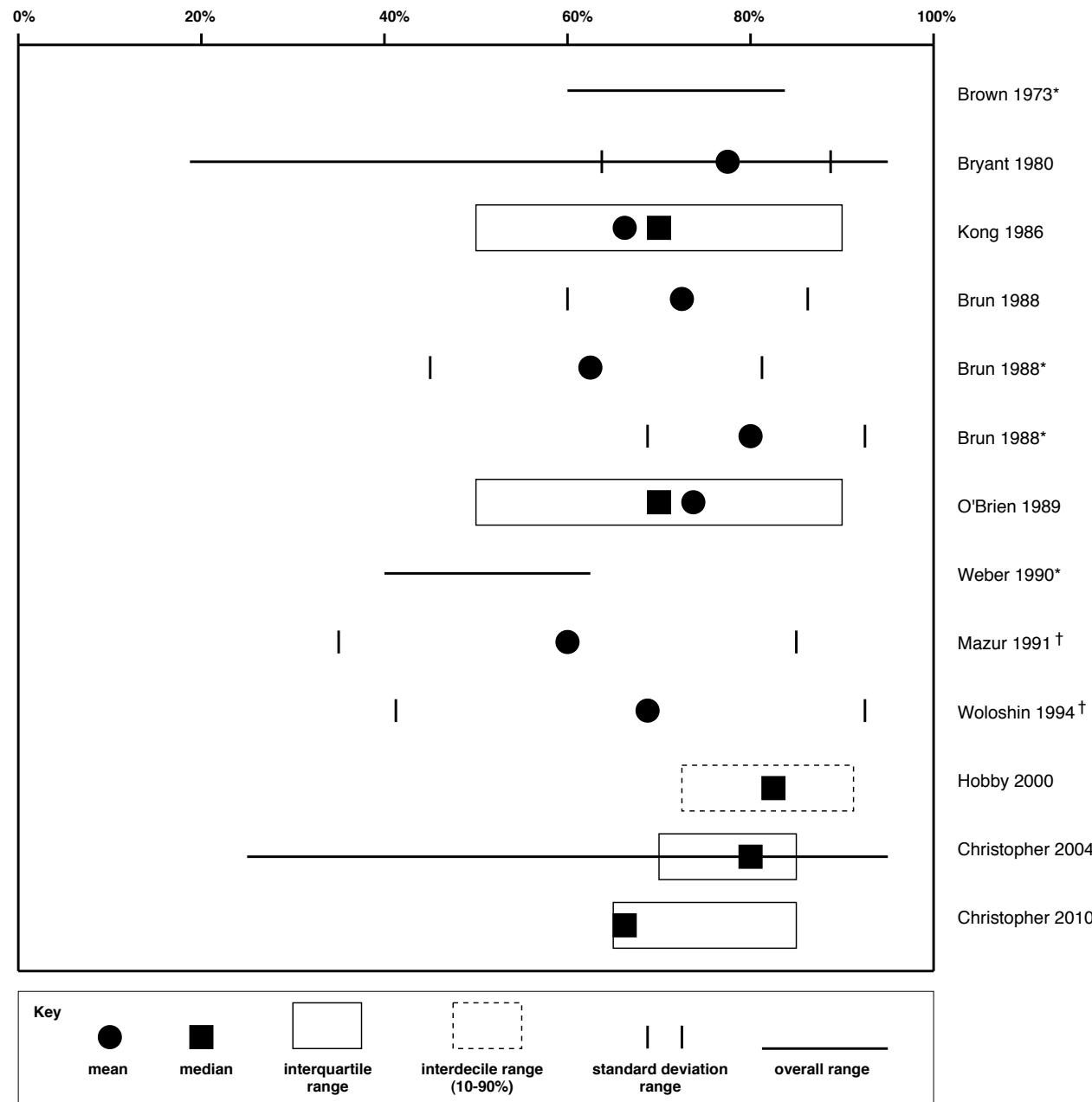
265 appeared in document corpus at least once

The top 33 hedge phrases most frequently discussed in the literature

Hedge Phrase	Citations
possible	17
unlikely	14
likely	14
probable	13
certain	12
never	10
sometimes	9
rarely	8
most likely	8
very likely	7
often	7
almost never	6
almost certain	6
perhaps	6
occasionally	6
frequent	6
compatible with	6

Hedge Phrase	Citations
improbable	5
always	5
rare	5
probably	5
consistent with	5
possibly	5
not	4
doubtful	4
not certain	4
low probability	4
usually	4
suggestive	4
diagnostic	4
not likely	4
low chance	4
likely	4

Estimated probabilities for the word **Probable**



Complete hedge phrases drawn from the corpus and MetaMap concepts within +/- 4 window

It is also **possible**, although **less likely**, that the **synechia** formed following nasal trauma...

I can find **little evidence** that the **thyroid** is the source of her cancer.

...hand pain and **numbness** which **may be associated** with **arthritis** with some nerve entrapment.

Possible but **inconclusive** source of **melena**.

The etiology of the patient's **fatigue** is **not clear** at this **time**.

He had normal range of **affect** and with **perhaps** some **mild anxiety**.

... **somewhat unlikely** that a **shunt occlusion** or migration would be the cause of her altered mental status

He continues to complain of insomnia and **jitteriness**, which I **suspect** is due to **prednisone**

The top 30 hedge phrases most frequently appearing in the study corpus

Hedge Phrase	Total number of Documents
may	24,036
possible	23,002
likely	21,307
positive	21,126
several	14,737
no evidence of	13,283
evidence of	12,350
most	12,293
consistent	11,189
unremarkable	10,374
few	9,769
usual	6,174
think	5,352
possibly	5,350
potential	5,116

Hedge Phrase	Total number of Documents
could be	4,739
most likely	4,625
appear	4,301
necessary	4,220
seems	3,882
probably	3,836
frequent	3,580
never	3,419
many	3,368
sure	3,368
suggest	3,328
apparently	3,302
occasionally	3,269
possibility of	3,046
diagnostic	2,813

100 most frequent hedge phrases in study corpus

potential

possible

may

likely

evidence

of

several

unremarkable

positive

consistent with

could be

common

occasionally

supportive

atypical

never

suspect

many

clearly

suggesting

certainly

does not appear

sometimes

frequent

risk for

often

possibility of

diagnostic

seems

normal

always

sure

suspicious

certain

likely

she may

typical

consistently

imply

think

possibly

expected

apparently

suggest

most likely

imply

The top **20** most frequent document types

Document Type	Total number of Documents	Proportion with ≥ 1 Hedge Phrase (%)
Admission History & Physical	1,879	98.08
Discharge Summary	4,753	93.18
Emergency Department Note	2,441	89.55
Letter	6,197	89.43
Consult - Inpatient - New	1,875	88.16
Note*	7,501	85.76
Consult - Inpatient	1,720	85.58
Letter/Note - Return Visit	18,509	85.53
Letter/Note - New Patient	2,558	82.13
Endoscopy Report	1,053	81.86
Progress Note	15,198	80.87
Social Work Note	1,865	79.03
Operative Report	2,412	78.57
Consult - Inpatient- Follow-up	4,462	77.63
Nutrition Note	2,199	74.17
Procedure Note	1,548	57.95
Phone Note	3,730	44.69
Physical Therapy Inpatient Note	1,121	38.45
Nursing Note	1,772	31.49
Nursing Procedure note	3,266	13.49

Hedge phrase usage by **clinical departments**

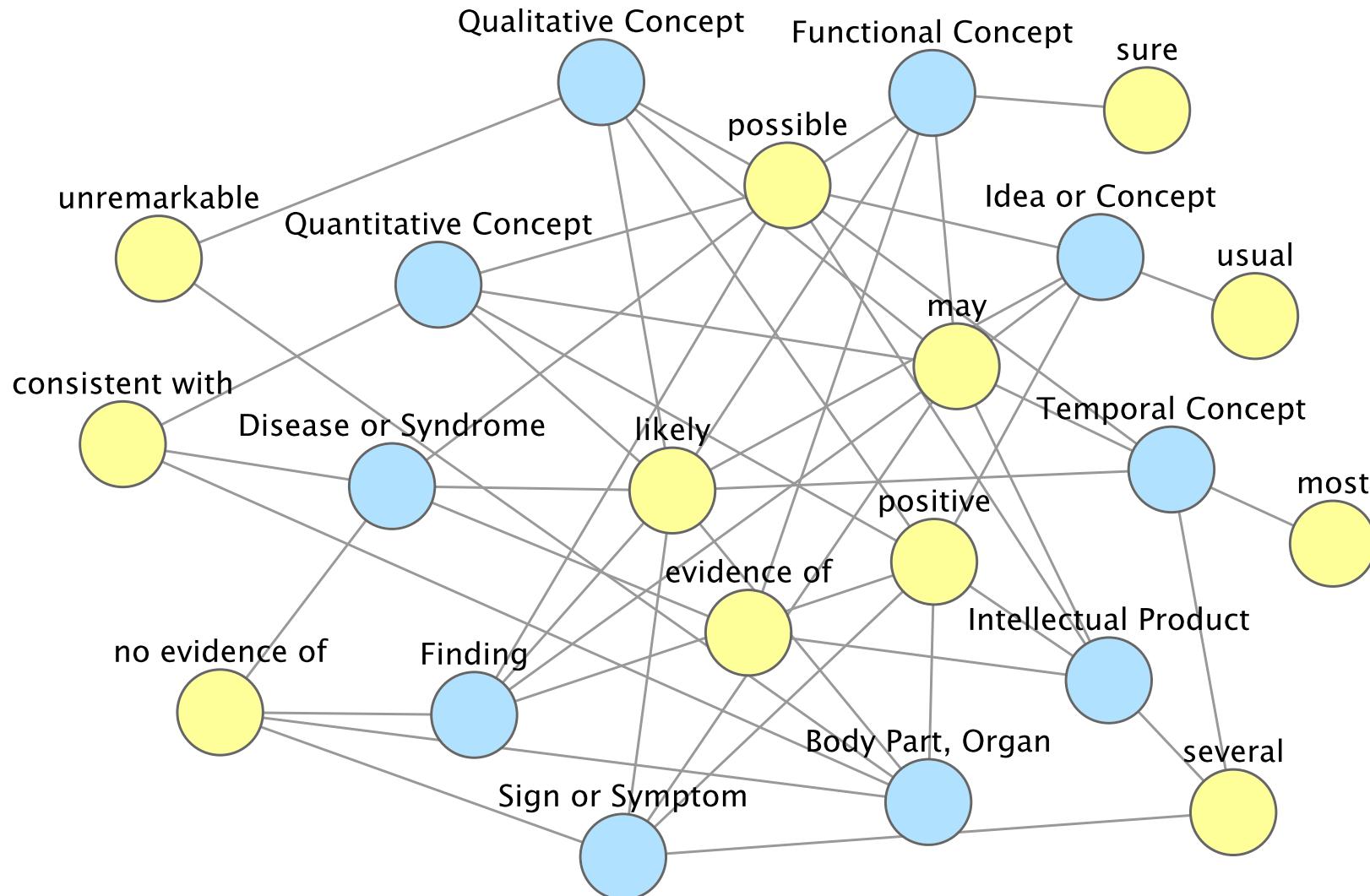
Group	Clinical Department	Total number of Documents	Proportion with ≥ 1 Hedge Phrase (%)
1	Psychiatry	291	93.47
	Emergency Medicine	3,737	91.06
	Neurology	1,833	90.67
2	Pediatrics	4,463	83.87
	Internal Medicine	35,943	83.51
	Family Medicine	2,177	83.28
3	Obstetrics and Gynecology	1,049	79.03
	Dermatology	1,057	76.44
	Ophthalmology	851	75.91
4	Orthopedic Surgery	603	70.65
	General Surgery	9,954	70.6
	Neurosurgery	1,005	68.76
5	Anesthesiology	1,290	65.35
6	Physical Medicine & Rehab	5,967	56.39
7	Nursing	6,817	33.93

UMLS semantic types associated with hedge phrases

UMLS Semantic Type	Freq.
Functional Concept	45,637
Qualitative Concept	39,159
Disease or Syndrome	34,785
Finding	33,024
Idea or Concept	22,607
Temporal Concept	20,149
Sign or Symptom	13,718
Quantitative Concept	13,380
Body Part, Organ, or Organ	12,422
Intellectual Product	11,120
Pathologic Function	10,902
Patient or Disabled Group	10,254
Activity	10,085
Therapeutic or Preventive	9,608
Neoplastic Process	8,576

UMLS Semantic Type	Freq.
Mental Process	7,589
Conceptual Entity	7,238
Health Care Activity	6,998
Spatial Concept	6,851
Diagnostic Procedure	6,221
Organic Chemical, Pharm.	5,186
Body Location or Region	5,022
Medical Device	4,591
Amino Acid, Protein,	4,579
Inorganic Chemical	4,475
Clinical Attribute	4,255
Organism Function	3,845
Body Substance	3,232
Laboratory Procedure	3,163
Geographic Area	3,023

Association between the 10 most common semantic types and 12 of the most frequently used hedge phrases



Conclusions

- ✓ Hedge phrases are **common** in EHR documentation at UMHS
- ✓ Physicians express uncertainty **more often** than nurses
- ✓ Clinical departments express uncertainty at **different rates**
- ✓ Hedge phrases are often associated with **clinically relevant** semantic types

The use of hedge phrases in clinical notes has the potential for unintended consequences as patients begin to gain direct access to their notes through patient portals. Strategies should be developed to better handle hedge phrases in patient-facing scenarios.



Future Work...

1. Apply the analysis to other EHR systems, including those with structured or semi-structured data entry.
2. Verify the relationship between hedge phrases and clinical concepts
3. Determine the true impact on patients when reading clinical documents with hedge phrases

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hanauer@umich.edu