

PROACT: Iterative Design of a Patient-Centered Visualization for Effective Prostate Cancer Health Risk Communication.

Hakone A, Harrison L, Ottley A, Winters N, Guthell C, Han PK, Chang R.

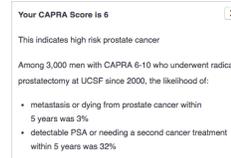
Presented by James Hicklin

Context: prostate cancer

- 80% of cases clinically localized
- Two treatment categories
 - Active treatment (surgery, radiation)
 - Conservative treatment (watch & wait)
- Only 10% of patients choose conservative treatment
 - Fear of cancer (“death sentence”)
 - Lack of information

Patient lack of information

- Existing tools physician-oriented
- Patient numeracy can be problematic
- Cognitive biases exist



System goals

- Improve prostate cancer patient understanding of their individual health risk information
- Provide a framework for physicians to guide them in communicating risk information

Design process

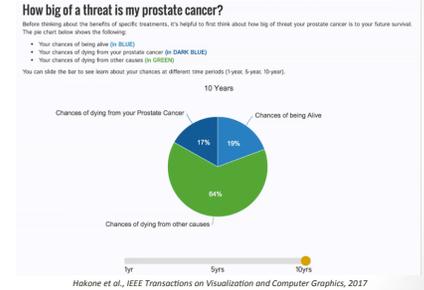
- Iterative design based off patient & doctor evaluation of prototype
- First iteration
 - Narrative established from consulting experts
 - Visualizations inspired from review of health risk communication literature
 - Data sourced from validated clinical prediction models

Clinical prediction models

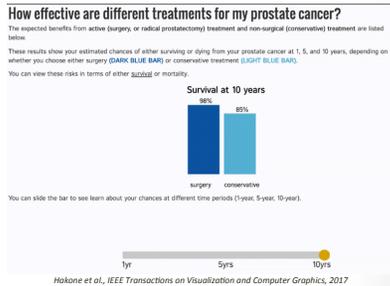
- Individualized prognosis estimates based on real evidence
- Not widely used
 - Incompatible with clinical practice
 - Not patient-oriented
- Two CPMs inform data in PROACT

Iteration #1

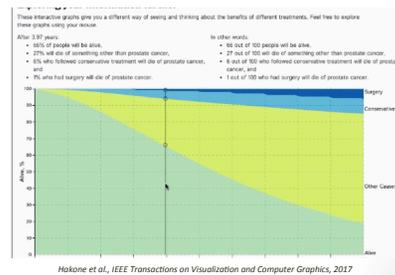
Risk of death



Probability of survival



Combined probabilities



Evaluation (iteration #1)

- 2 urologists and 6 prostate cancer survivors
- Hypothetical scenarios completed (patients: 4, urologists: 1)
- Decision confidence assessed at 4 points (patients only)

Findings (iteration #1)

- Sequence of narrative important – “How much time do I have left?”
- Difficult to reason without this
- Context is critical – heightened emotional state causes difficulty in processing information
 - Suggests that first step of tool should calm the patient down

Findings (iteration #1)

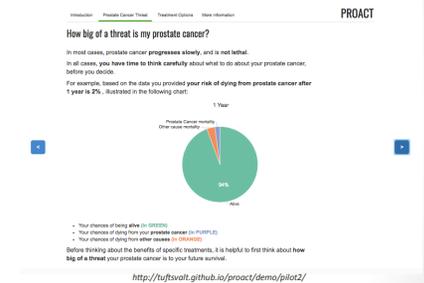
- Sliders controlling temporal element were completely ignored
- Temporal area chart not understood by 6 out of 8 participants
- Perhaps participant demographics not properly considered
 - “I like numbers, but I’m old so I often need time to study graphs”

Findings (iteration #1)

- Participants confused as colors across visualizations were inconsistent, despite data being conditionally linked

Iteration #2

PROACT demo



Discussion

- All patients recalled lack of information provided by physician, and resorted to searching the internet for information
- Study contributions:
 - Allows patient access and understanding of clinical prediction models
 - Communication guide for consultations

Discussion: design guidelines

- Account for user's emotional state
 - Narrative flow of visualization is critical
- Distill complex models into simple visualizations
 - Minimize interaction
 - Sacrifices exploration
 - But for general public, this may improve understanding of data
- Grounded iterative design
 - Effective when used in target user groups

Critique

- Pros
 - Sample representative of target user
 - Converts physician-oriented clinical prediction models to patient-oriented risk visualizations
 - Simple visualizations so that wide range of target users can understand information

Critique

- Cons
 - Iterative process feels a little contrived – cannot imagine any 80 year old being able to understand the temporal area chart.
 - Sample size small
 - No effort made to represent and convey uncertainty
 - Only accounts for two treatments – other treatments available but not discussed
 - Only takes survival into account – other attributes (side effects, cost, etc.) not considered

References

- Hakone, Anzu, Lane Harrison, Alvitta Ottley, Nathan Winters, Caitlin Gutheil, Paul K. J. Han, and Remco Chang. "PROACT: Iterative Design of a Patient-Centered Visualization for Effective Prostate Cancer Health Risk Communication." *IEEE Transactions on Visualization and Computer Graphics* 23.1 (2017): 601-10.
- Stephenson, Andrew J., Michael W. Kattan, James A. Eastham, Eric A. Klein, Fernando J. Bianco, Andrew J. Vickers, Ofer Yossepowitch, and Peter T. Scardino. "Prostate Cancer-Specific Mortality After Radical Prostatectomy For Patients Treated In The Prostate-Specific Antigen Era." *The Journal of Urology* 179.4 (2008): 649.
- Lu-Yao, Grace L. "Outcomes of Localized Prostate Cancer Following Conservative Management." *Jama* 302.11 (2009): 1202.

Thank you!

Questions?