Moving from Individual Predictions to Population Priorities in Suicide Prevention

Philip Resnik

University of Maryland
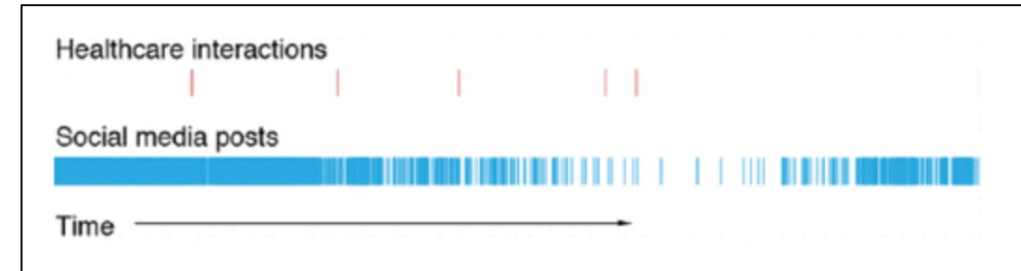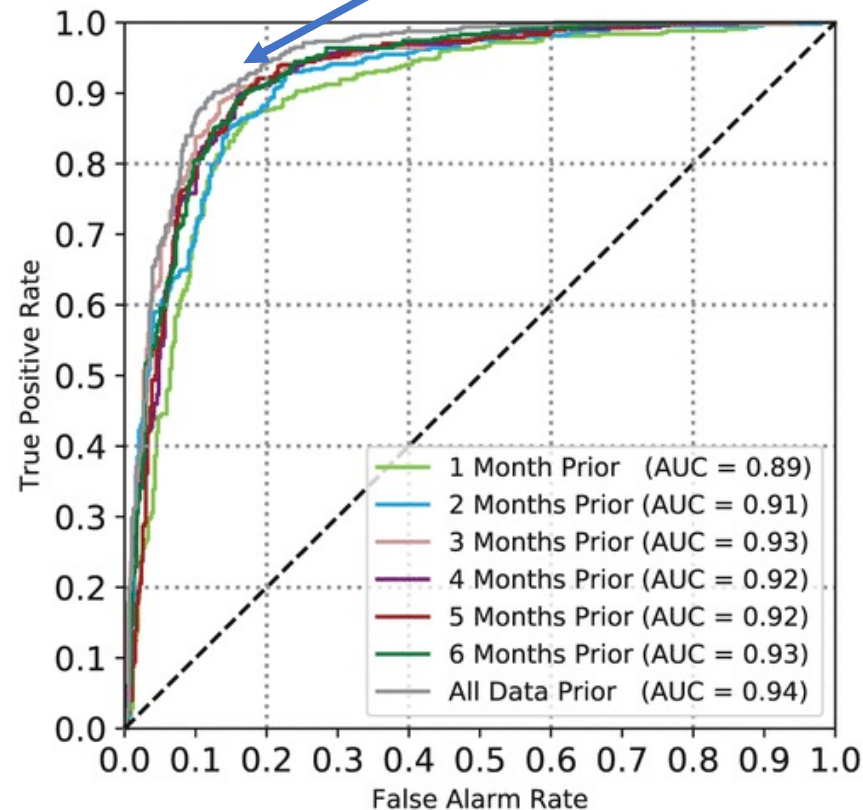
This talk includes discussion of suicide.

If you are feeling like you (or someone you know) could use some support or assistance, we encourage you and to reach out to the National Suicide Prevention Lifeline at 800-273-8255 (800-273-TALK) or to Crisis Text Line by texting HOME to 741741.

For a more extensive, international list of resources, see https://www.reddit.com/r/SuicideWatch/wiki/hotlines

**90-95% true positives,
With only 10-20% false positives**

Coppersmith, Glen, et al. "Natural language processing of social media as screening for suicide risk." Biomedical informatics insights 10 (2018): 1178222618792860.

- Predicting attempts better than clinicians
- Ethical social media collection via data donation*
- *Events*, not ratings or proxy variables**

*Benton, Adrian, Glen Coppersmith, and Mark Dredze. "Ethical research protocols for social media health research." Proceedings of the first ACL workshop on ethics in natural language processing. 2017.

*Chancellor, Stevie, et al. "A taxonomy of ethical tensions in inferring mental health states from social media." Proceedings of the conference on fairness, accountability, and transparency. 2019.

**Cf. Ernala, Sindhu Kiranmai, et al. "Methodological gaps in predicting mental health states from social media: triangulating diagnostic signals." *Proceedings of the 2019 CHI conference on human factors in computing systems*. 2019.
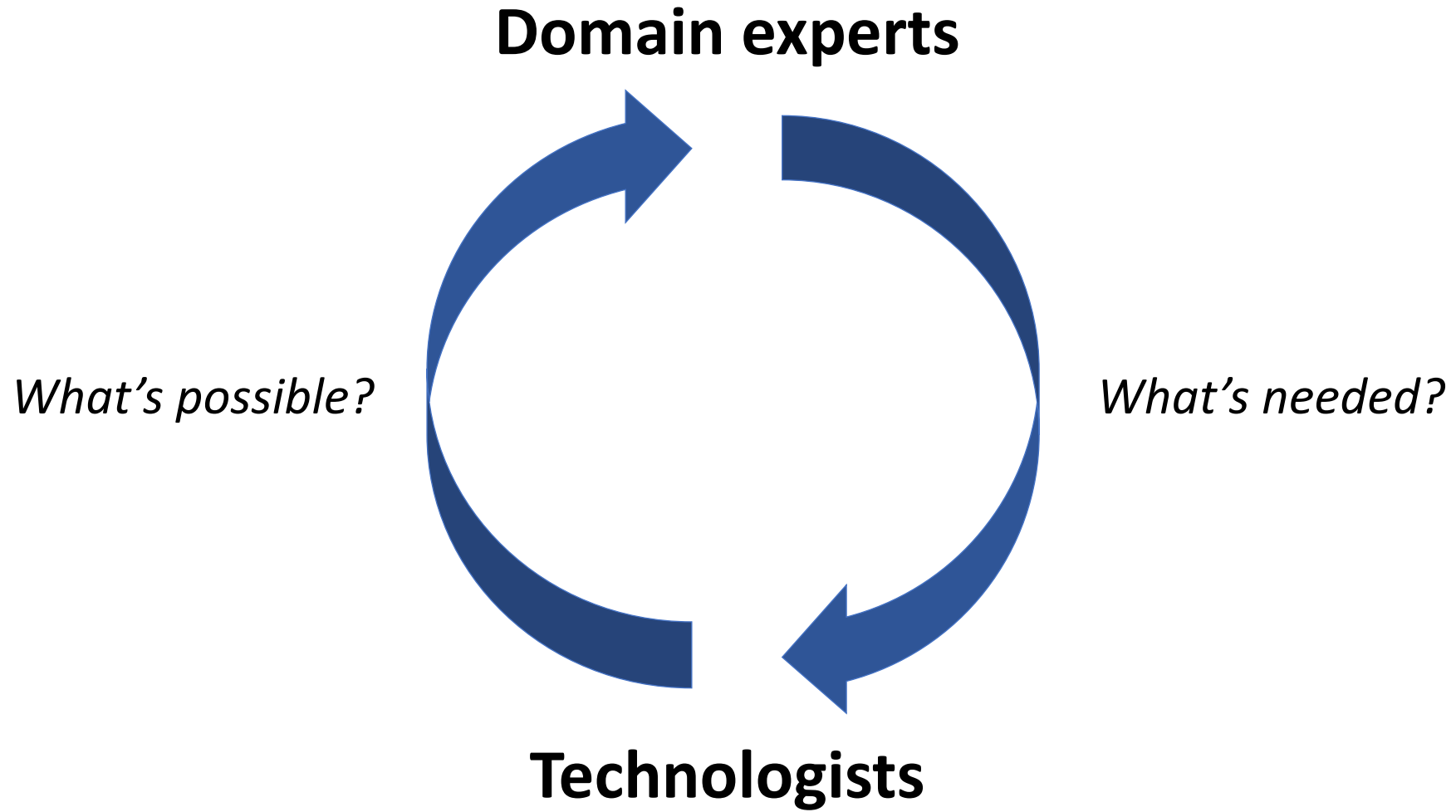
Then what? [*]

*Resnik, P., Foreman, A., Kuchuk, M., Musacchio Schafer, K., & Pinkham, B. (2021). Naturally occurring language as a source of evidence in suicide prevention. *Suicide and Life-Threatening Behavior*, *51*(1), 88-96

Dr. Melissa Dennison, a pediatrician in Glasgow, Ky. "If I've got this child and they're cutting and saying they're going to kill themselves, I'll say, 'Well, I'll see them today,'" she said. "If I call a child psychiatrist, they say, 'I'll see them in a month.'"

Matt Richtel, "Pediatricians Hold the Front Lines of a Mental Health Crisis", New York Times, May 10, 2022.

A month is optimistic in the extreme these days.

Rebecca Resnik, clinical psychologist

Domain experts

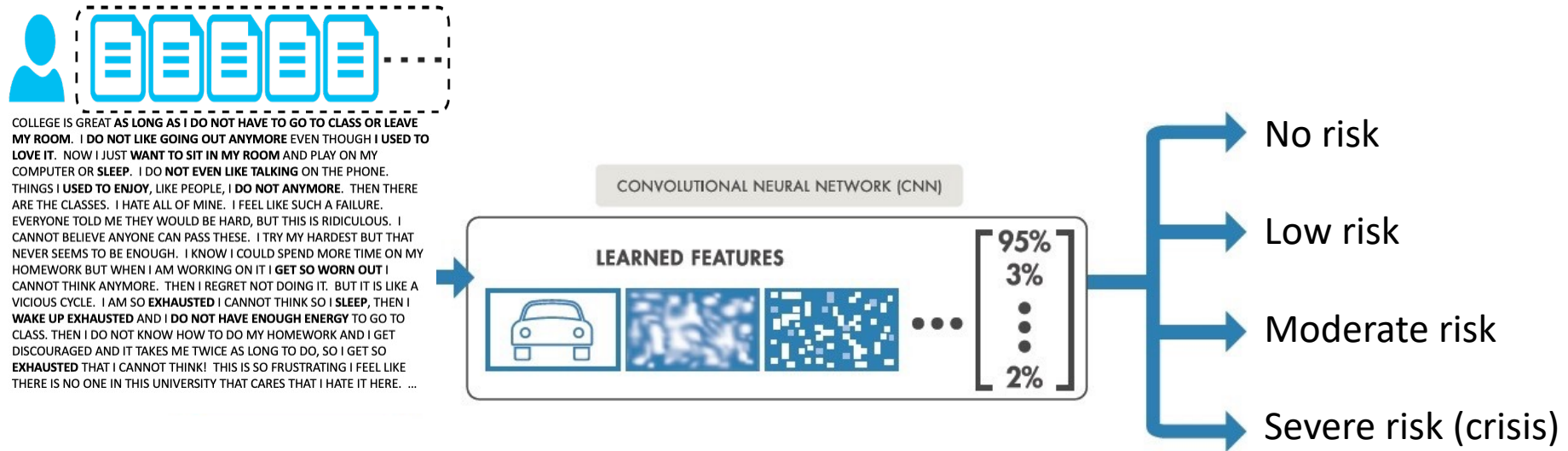**What's possible?**

What's needed?

Technologists

What's possible?
Matching needs with solutions

- Moving from classification to prioritization

- Helping providers understand people's risk in context

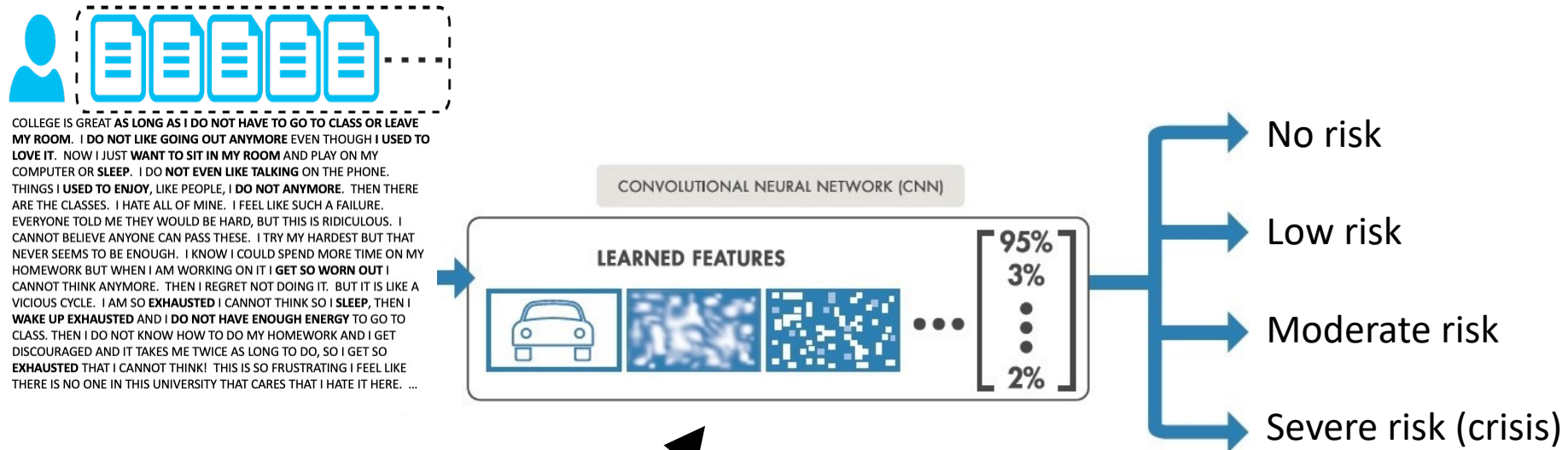- Gaining insights from lived experiences

From classification to prioritization

TECHNOLOGY-CENTRIC VIEW OF THE PROBLEM

COLLEGE IS GREAT **AS LONG AS I DO NOT HAVE TO GO TO CLASS OR LEAVE MY ROOM**. I **DO NOT LIKE GOING OUT ANYMORE** EVEN THOUGH **I USED TO LOVE IT**. NOW I JUST **WANT TO SIT IN MY ROOM** AND PLAY ON MY COMPUTER OR **SLEEP**. I DO **NOT EVEN LIKE TALKING** ON THE PHONE. THINGS I **USED TO ENJOY**, LIKE PEOPLE, I **DO NOT ANYMORE**. THEN THERE ARE THE CLASSES. I HATE ALL OF MINE. I FEEL LIKE SUCH A FAILURE. EVERYONE TOLD ME THEY WOULD BE HARD, BUT THIS IS RIDICULOUS. I CANNOT BELIEVE ANYONE CAN PASS THESE. I TRY MY HARDEST BUT THAT NEVER SEEMS TO BE ENOUGH. I KNOW I COULD SPEND MORE TIME ON MY HOMEWORK BUT WHEN I AM WORKING ON IT I **GET SO WORN OUT** I CANNOT THINK ANYMORE. THEN I REGRET NOT DOING IT. BUT IT IS LIKE A VICIOUS CYCLE. I AM SO **EXHAUSTED** I CANNOT THINK SO I **SLEEP**, THEN I **WAKE UP EXHAUSTED** AND I **DO NOT HAVE ENOUGH ENERGY** TO GO TO CLASS. THEN I DO NOT KNOW HOW TO DO MY HOMEWORK AND I GET DISCOURAGED AND IT TAKES ME TWICE AS LONG TO DO, SO I GET SO **EXHAUSTED** THAT I CANNOT THINK! THIS IS SO FRUSTRATING I FEEL LIKE THERE IS NO ONE IN THIS UNIVERSITY THAT CARES THAT I HATE IT HERE. …

No risk

Low risk

Moderate risk

Severe risk (crisis)

From classification to prioritization

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CONVOLUTIONAL NEURAL NETWORK (CNN)

LEARNED FEATURES

95%
3%
⋮
2%

No risk

Low risk

Moderate risk

Severe risk (crisis)

It's usually hard or impossible to understand what features were used – *why* labels are chosen.

Labels alone don't provide within-risk-level ranking
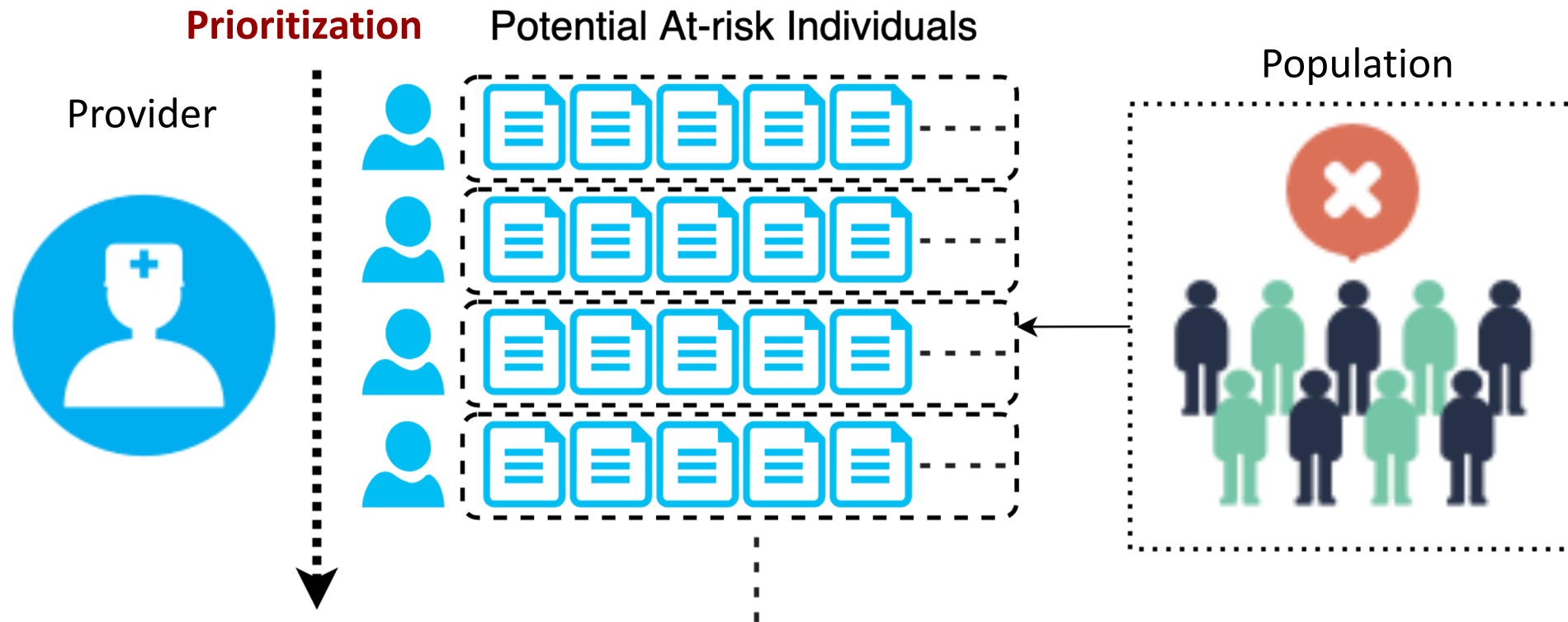
From classification to prioritization
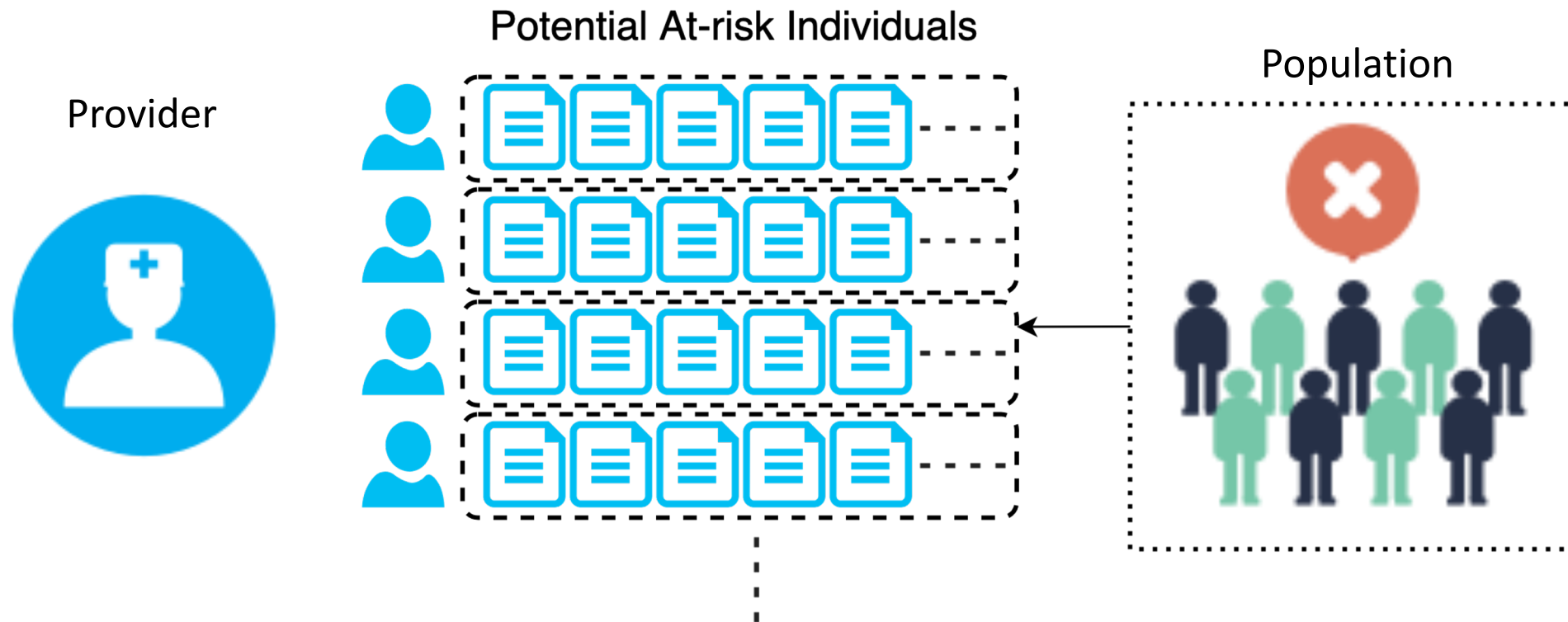
Shing, Han-Chin, Philip Resnik, and Douglas W. Oard. "A prioritization model for suicidality risk assessment." In *Proceedings of the 58th Annual Meeting of the Association for Computational Linguistics*, pp. 8124-8137. 2020. (Also applies to subsequent slides)
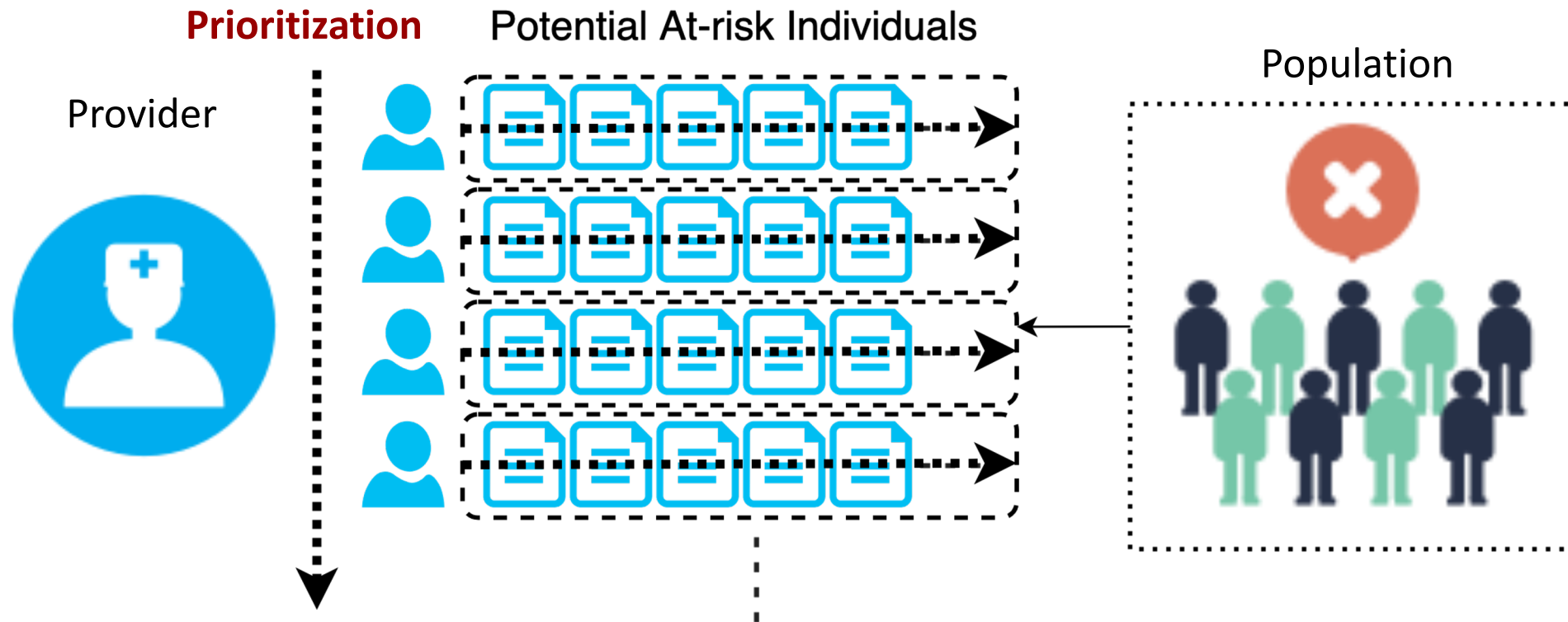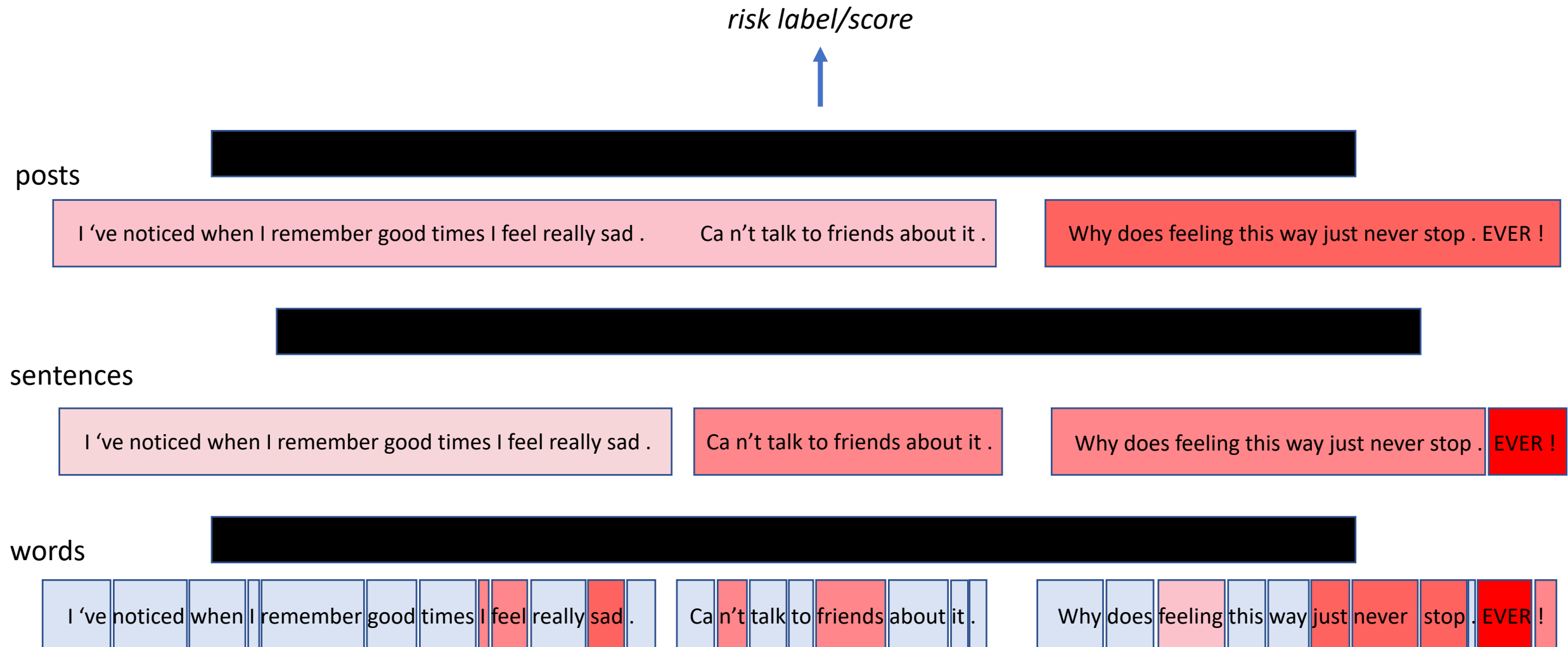
From classification to prioritization

Prioritization

Potential At-risk Individuals

Provider

Population

From classification to prioritization

From classification to prioritization

risk label/score

↑

posts

| I 've noticed when I remember good times I feel really sad .   Ca n't talk to friends about it . | Why does feeling this way just never stop . EVER ! |

sentences

| I 've noticed when I remember good times I feel really sad . | Ca n't talk to friends about it . | Why does feeling this way just never stop . EVER ! |

words

I 've noticed when I remember good times I feel really sad . Ca n't talk to friends about it . Why does feeling this way just never stop . EVER !

From classification to prioritization

From classification to prioritization

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Low risk

Moderate risk

Severe risk (crisis)

How do we measure success?
   Accuracy

From classification to prioritization
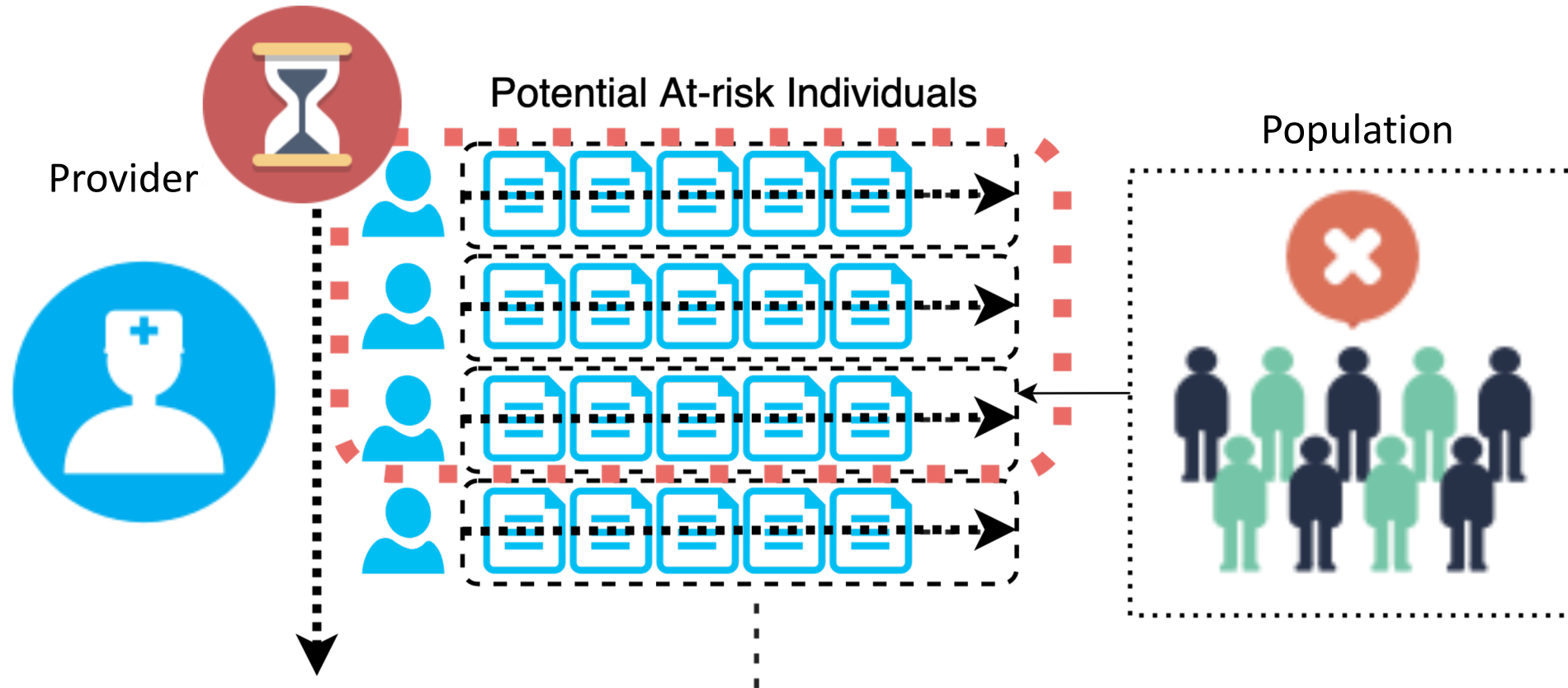
How do we measure success?
  ~~Accuracy~~
  Expected number of identified high-risk individuals, <u>given a limited time budget</u>

(Simulated) provider-centric evaluation

Individual Rankers	Document Rankers	Number of at-risk people identified (1hr)	Number of at-risk people identified (3hrs)	Number of at-risk people identified (6hrs)
LR	Forward	7.51	10.05	10.89
3HAN_Av	Forward	7.76	10.15	10.94
3HAN	Forward	7.40	9.98	10.84
LR	Backward	8.75	11.70	12.68
3HAN_Av	Backward	9.65	12.09	12.89
3HAN	Backward	9.73	12.17	12.95
LR	3HAN_Att	9.44	12.05	12.88
3HAN_Av	3HAN_Att	10.16	12.35	13.04
3HAN	3HAN_Att	**10.39**	**12.49**	**13.12**

Shing, Han-Chin, et al. "Expert, crowdsourced, and machine assessment of suicide risk via online postings." Proceedings of the fifth workshop on computational linguistics and clinical psychology: from keyboard to clinic. 2018.

What's possible?
Matching needs with solutions

- Moving from classification to prioritization

- Helping providers understand people's risk in context

- Gaining insights from lived experiences

Top down: looking <u>for</u> evidence through the lens of known categories/constructs/patterns

"[Despair], owing to some evil trick played upon the sick brain by the inhabiting psyche, comes to resemble the diabolical **discomfort** of being **imprisoned** in a fiercely **overheated** room. And because no breeze stirs this cauldron, because there is no escape from this **smothering confinement**, it is entirely natural that the victim begins to think ceaselessly of oblivion."

— Dr. Kay Redfield Jamison, *Night Falls Fast: Understanding Suicide*

Entrapment

Schuck, Allison; Calati, Raffaella; Barzilay, Shira; Bloch-Elkouby, Sarah; Galynker, Igor (May 2019). "Suicide Crisis Syndrome: A review of supporting evidence for a new suicide-specific diagnosis". Behavioral Sciences & the Law. 37 (3): 223–239. doi:10.1002/bsl.2397.

Top down: looking <u>for</u> evidence through the lens of known categories/constructs/patterns

Crisis in past 2 weeks or upcoming 2 weeks

Social or relationship problem

Finance or job problem

Physical health problem

Alcohol dependence

Other substance use problem

Legal problem

School- or academic-related problem

Death of a friend or family member

Explicit statement of mental health symptoms or diagnosis other than suicidality

Positive social support presence in life

Desire to get better or feel better

Lack of means to harm self (perceived or actual)

Engagement in activities

Sense of purpose or hope

Access to health or mental health care

Stevie Chancellor, Steven A Sumner, Corinne David-Ferdon, Tahirah Ahmad, Munmun De Choudhury. (2021). Suicide risk and protective factors in online support forum posts: annotation scheme development and validation study. In JMIR Mental Health.

Bottom up: discovering categories/constructs you might not have known about

COLLEGE IS GREAT AS LONG AS I DO NOT HAVE TO GO TO CLASS OR LEAVE MY ROOM. I DO NOT LIKE GOING OUT ANYMORE EVEN THOUGH I USED TO LOVE IT. NOW I JUST WANT TO SIT IN MY ROOM AND PLAY ON MY COMPUTER OR SLEEP. I DO NOT EVEN LIKE TALKING ON THE PHONE. THINGS I USED TO ENJOY, LIKE PEOPLE, I DO NOT ANYMORE. THEN THERE ARE THE CLASSES. I HATE ALL OF MINE. I FEEL LIKE SUCH A FAILURE. EVERYONE TOLD ME THEY WOULD BE HARD, BUT THIS IS RIDICULOUS. I CANNOT BELIEVE ANYONE CAN PASS THESE. I TRY MY HARDEST BUT THAT NEVER SEEMS TO BE ENOUGH. I KNOW I COULD SPEND MORE TIME ON MY HOMEWORK BUT WHEN I AM WORKING ON IT I GET SO WORN OUT I CANNOT THINK ANYMORE. THEN I REGRET NOT DOING IT. BUT IT IS LIKE A VICIOUS CYCLE. I AM SO EXHAUSTED I CANNOT THINK SO I SLEEP, THEN I WAKE UP EXHAUSTED AND I DO NOT HAVE ENOUGH ENERGY TO GO TO CLASS. THEN I DO NOT KNOW HOW TO DO MY HOMEWORK AND I GET DISCOURAGED AND IT TAKES ME TWICE AS LONG TO DO, SO I GET SO EXHAUSTED THAT I CANNOT THINK! THIS IS SO FRUSTRATING I FEEL LIKE THERE IS NO ONE IN THIS UNIVERSITY THAT CARES THAT I HATE IT HERE. ...

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Inferring population-specific categories from language

Notes	Valence	Regression value	Top 20 words
social engagement	p	-1.593	game play football team watch win sport ticket texas season practice run basketball lose so
social engagement	p	-1.122	music song listen play band sing hear sound guitar change remind cool rock concert voice
social engagement	p	-0.89	party night girl time fun sorority meet school house tonight lot rush drink excite fraternity
social engagement	p	-0.694	god die church happen day death lose doe bring care pray live plan close christian control
high emotional valence	e	-0.507	hope doe time bad wait glad nice happy worry guess lot fun forget bet easy finally suck fin
somatic complaints	n	-0.205	cold hot hair itch air light foot nose walk sit hear eye rain nice sound smell freeze weather
poor ego control; immature	n	0.177	yeah wow minute haha type funny suck hmm guess blah bore gosh ugh stupid bad lol hey
relationship issues	n	0.234	call talk miss phone hope mom mad love stop tonight glad dad weird stupid matt email any
homesick; emotional distress	n	0.34	home miss friend school family leave weekend mom college feel parent austin stay visit lo
social engagement	p	0.51	friend people meet lot hang roommate join college nice fun club organization stay social t
negative affect*	n	0.663	suck damn stupid hate hell drink shit fuck doe crap smoke piss bad kid drug freak screw cr
high emotional valence	e	0.683	life change live person future dream realize mind situation learn goal grow time past enjoy
sleep disturbance*	n	0.719	sleep night tire wake morning bed day hour late class asleep fall stay nap tomorrow leave n
high emotional valence	e	0.726	love life happy person heart cry sad day feel world hard scar perfect feeling smile care stro
memories	n	0.782	weird talk doe dog crazy time sad stuff funny haven happen bad remember day hate lot sca
somatic complaints*	n	0.805	hurt type head stop eye hand start tire feel time finger arm neck move chair stomach bother
anxiety*	n	1.111	feel worry stress study time hard lot relax nervous test focus school anxious concentrate p
emotional discomfort	n	1.591	feel time reason depress moment bad change comfortable wrong lonely feeling idea lose g
homesick; emotional distress*	n	2.307	hate doe sick feel bad hurt wrong care happen mess horrible stupid mad leave worse anym

Supervised LDA topics from undergraduate stream-of-consciousness essays identified by a clinician as most relevant for assessing depression. Supervision (regression) is based on Z-scored Big-5 scores for emotional instability (neuroticism).

Inferring population-specific categories from language

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Supervised LDA topics from undergraduate stream-of-consciousness essays identi...
assessing depression. Supervision (regression) is based on Z-scored Big-5 scores f...

> game play football team watch win…
> music song listen play band sing hear…
> party night girl time fun sorority meet…

> sleep night tire wake morning bed day hour
> late class asleep fall stay nap

> hurt type head stop eye hand start tire feel
> time finger arm neck move chair stomach

> feel worry stress study time hard lot relax
> nervous test focus school anxious

What's possible?
Matching needs with solutions

- Moving from classification to prioritization

- Helping responders understand what's going on with people

- **Gaining insights from lived experiences**

Every lived experience is an N of 1.

Rebecca Resnik, clinical psychologist

Reddit post by u/firegate2233:

Formerly suicidal redditors, what's something that kept you alive a little while longer and helped you to get through the dark times in your lives ?

This post received 16,648 responses in about a day.

Topic 4, Topic 22, Topic 6, Topic 25, Topic 3, Topic 16
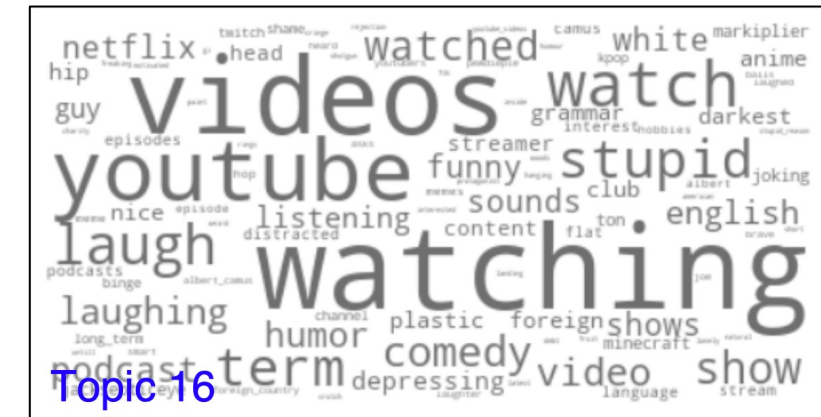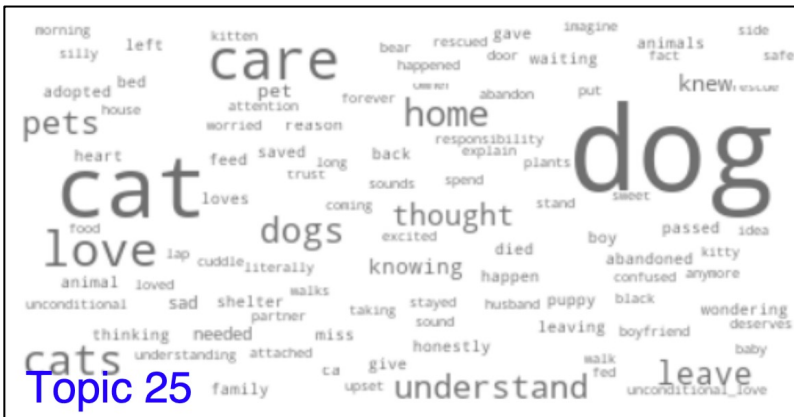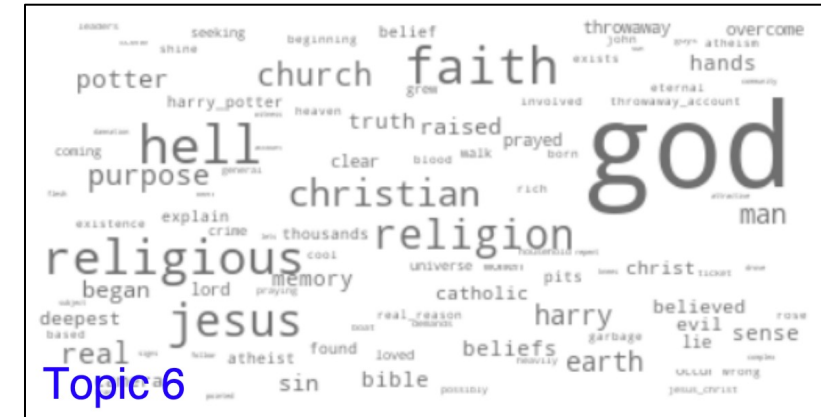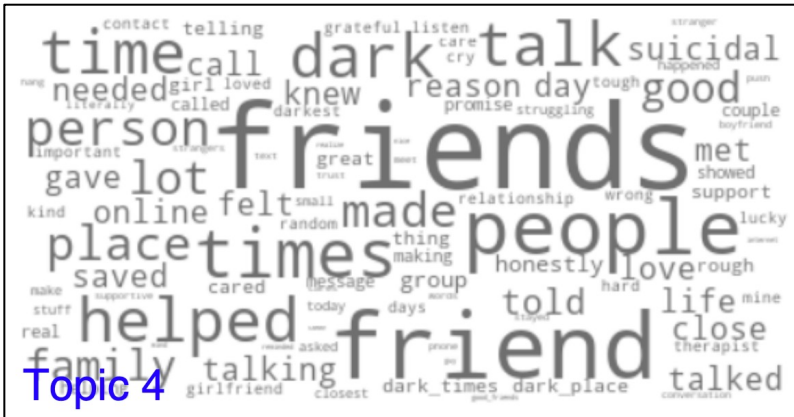
Philip Resnik, Josh Hagedorn, Katherine Musacchio Schafer, Rebecca Resnik, Jonathan Singer.
"Reasons to Live: A Thematic Analysis of 16,648 Self-Reports". Suicide Research Symposium, June 16-17, 2022.
https://www.suicideresearchsymposium.com/

Take-aways

Automated labeling/classification isn't enough in a *resource-limited* world

Population-level data holds bottom-up insights
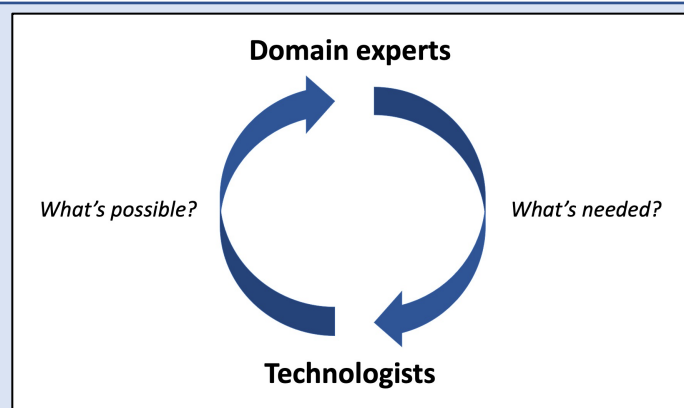
We need to be wary of technology-driven mental health efforts: progress requires engagement of tech with the mental health ecosystem
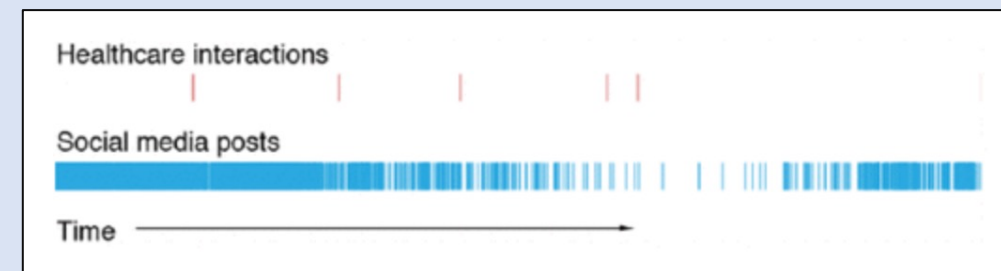
Real progress *requires* community-level access to relevant data

Thank you!

Collaborators