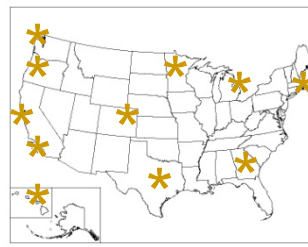


Outcome definitions and risk thresholds for prevention programs (the case of suicide attempt prevention)

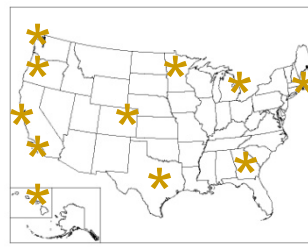
Greg Simon – Group Health Research Institute

UH2 AT007755 – Pragmatic trial of population-based programs to prevent suicide attempt



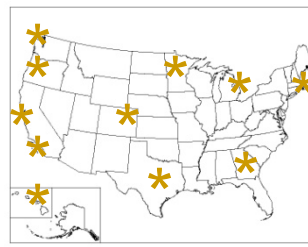
Agenda

- Background on screening for risk of suicidal behavior
- Identifying suicidal behavior from health system electronic records
- Self-reported suicidal ideation as a screening test
- Selecting the right risk threshold for preventive intervention
- Improving sensitivity



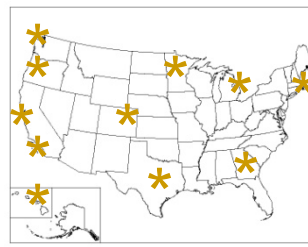
Background: Suicide and suicide attempt

- 10th ranked cause of death in US (38,000/yr)
- 600,000 ED visits and 200,000 hospitalizations each year



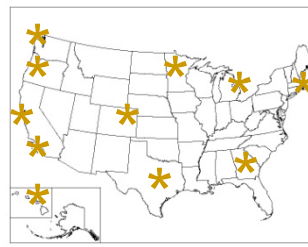
Three levels of prevention for suicidal behavior

- Universal (primary) – Moderate evidence for reducing access to lethal means (e.g. bridge barriers)
- Selective (secondary) – **NOTHING**
- Indicated (tertiary) – Moderate evidence for clinical interventions following suicide attempt



Key ingredients for implementing and evaluating selective prevention:

- Feasible and accurate screening test
- Accurate assessment of population-level outcomes



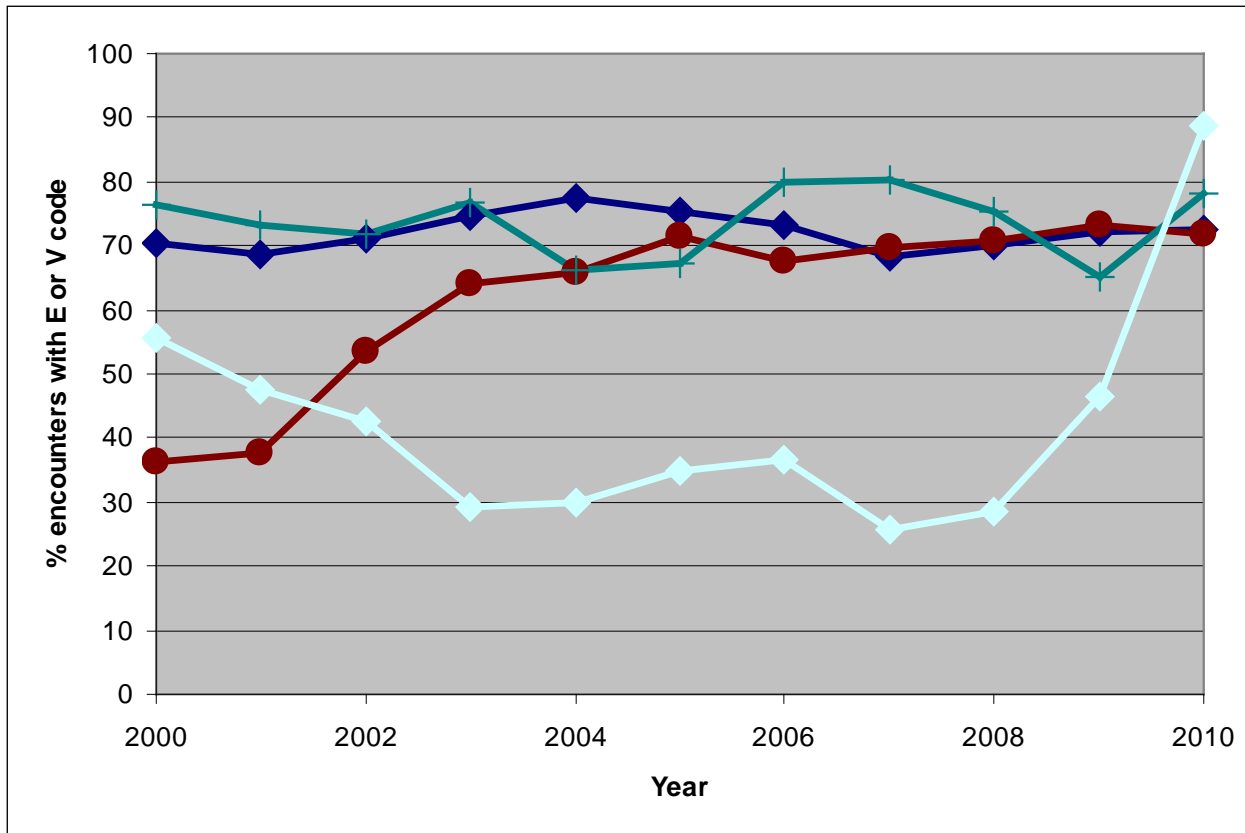
Identifying suicide attempts from claims/EMR data

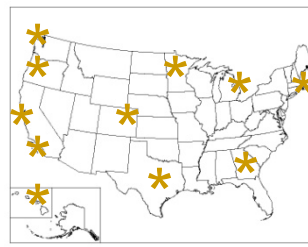
E-code (cause of injury code)

- ❑ Definite self-inflicted injury (E950)
- ❑ Possible self-inflicted injury (E980)



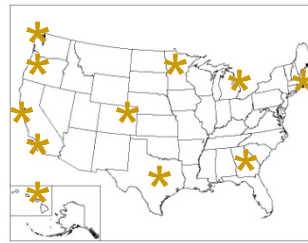
Any E code in injury/poisoning encounters





Definite and possible self-inflicted injury diagnoses at potential sites in 2010 (rates per thousand)

Definite (E950)	0.62	0.64	0.76
Possible (E980)	0.31	0.30	0.39
Either	0.89	0.91	1.02



Database Matches

Match: suicide attempt

Find

ID	Name	HCC
E958.9U	Suicide attempt	55
965.4AS	Suicide attempt by acetaminophen overdose	
E958.9E	Suicide attempt by adequate means	55
980.0Y	Suicide attempt by alcohol poisoning	
971.3AE	Suicide attempt by beta blocker overdose	
971.3AF	Suicide attempt by beta-adrenergic antagonist overdose	
986AQ	Suicide attempt by carbon monoxide poisoning	
977.9BY	Suicide attempt by drug ingestion	
E958.9G	Suicide attempt by inadequate means	55
977.9CC	Suicide attempt by multiple drug overdose	
969.8K	Suicide attempt by other psychotropic drug overdose	
969.5AY	Suicide attempt by other tranquilizer drug overdose	
E950.0BN	Suicide attempt using analgesics	55
V15.89JM	H/O suicide attempt	
V15.89U	H/O: suicide attempt	
300.9DY	Suicide threat or attempt	
E958.9J	Unsuccessful suicide attempt	55
E958.9C	First known suicide attempt	55
V15.89T	History of suicide attempt	
V15.89JN	Hx of suicide attempt	
V15.89R	Previous known suicide attempt	
986AR	Carbon monoxide poisoning, suicide attempt	
E958.9AM	Cause of injury, suicide attempt	55
V17.0BQ	Family history of suicide attempt	
V71.89S	Observation following alleged suicide attempt	
994.8AN	Electric shock caused by electroshock gun in suicide attempt	
994.8AQ	Electric shock caused by stun gun gun in suicide attempt	
994.8AP	Electric shock caused by Taser gun in suicide attempt	
E958.9R	Attempted suicide	55
994.8AY	Attempted suicide using electroshock gun	
V15.89AH	H/O: attempted suicide	
V15.89V	History of attempted suicide	

Preference List (F5)

Accept

Cancel



Database Matches

Match:

Find

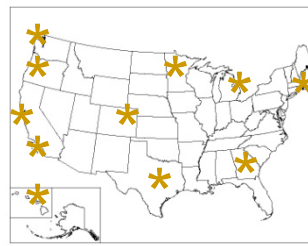
ID	Name	HCC
300.9BH	Suicidal behavior	
989.9BQ	Suicidal deliberate poisoning	
V62.84	Suicidal ideation	
V62.84F	Suicidal ideations	
V62.84B	Suicidal intent	
977.9BZ	Suicidal overdose	
300.9FZ	Suicidal risk	
V62.84A	Suicidal thoughts	
E958.9N	Suicide	55
967.0CD	Suicide and self inflicted poisoning by barbiturates	
E953.9G	Suicide and self-inflicted hanging, strangulation, and suffocation	55
E957.9B	Suicide and self-inflicted injuries by jumping from high place	55
E957.0	Suicide and self-inflicted injuries by jumping from residential premises	55
E957.1	Suicide and self-inflicted injuries by jumping from other man-made structures	55
E957.2	Suicide and self-inflicted injuries by jumping from natural sites	55
E957.9	Suicide and self-inflicted injuries by jumping from unspecified site	55
E958.9AJ	Suicide and self-inflicted injury	55
E955.6	Suicide and self-inflicted injury by air gun	55
E955.6A	Suicide and self-inflicted injury by BB gun	55
E958.1	Suicide and self-inflicted injury by burns, fire	55
E958.7	Suicide and self-inflicted injury by caustic substances, except poisoning	55
E958.7A	Suicide and self-inflicted injury by caustic substance	55
E958.6	Suicide and self-inflicted injury by crashing of aircraft	55
E958.5	Suicide and self-inflicted injury by crashing of motor vehicle	55
E956	Suicide and self-inflicted injury by cutting and piercing instrument	55
E958.4	Suicide and self-inflicted injury by electrocution	55
E955.5	Suicide and self-inflicted injury by explosives	55
E958.3	Suicide and self-inflicted injury by extremes of cold	55
E955.4A	Suicide and self-inflicted injury by firearm	55
E955.9	Suicide and self-inflicted injury by firearms and explosives, unspecified	55
E955.9B	Suicide and self-inflicted injury by firearms and explosives	55
E955.9D	Suicide and self-inflicted injury by firearms, air guns and explosives	55
E955.0	Suicide and self-inflicted injury by handgun	55
E953.0	Suicide and self-inflicted injury by hanging	55
E953.9J	Suicide and self-inflicted injury by hanging, strangulation, and suffocation	55
E955.2	Suicide and self-inflicted injury by hunting rifle	55
E957.0A	Suicide and self-inflicted injury by jumping from residential premises	55
E957.1A	Suicide and self-inflicted injury by jumping from man-made structures	55

Preference List (F5)

Accept

Cancel

50 Loaded. More to load.



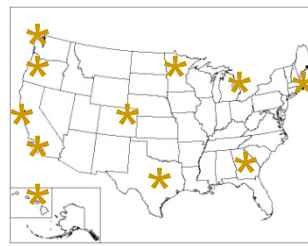
Identifying suicide attempts from claims/EMR data

- E-code (cause of injury code)
 - Definite self-inflicted injury (E950)
 - Possible self-inflicted injury (E980)
- V-code (V62.84) for suicidal ideation
- Telephone consulting nurse encounters with complaint of “suicide attempt”



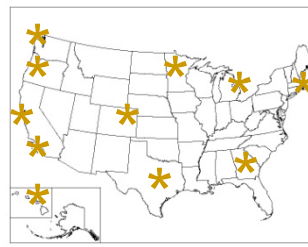
PPV of specific criteria for identifying suicide attempts

	% of All Incidents Identified	Documented self-inflicted injury with suicidal intent	Documented self-inflicted injury w/o suicidal intent	Possible self-inflicted injury	No documentation of self-inflicted injury
Definite self-inflicted injury (E950-E958)	55%	100%	0%	0%	0%
Possible self-inflicted injury (E980-E988)	29%	70%	10%	10%	10%
Injury/poisoning plus V62.84	7%	71%	8%	12%	9%
Phone encounter for "Suicide Attempt"	9%	88%	0%	0%	12%
Weighted Average for All Criteria		88%	3%	4%	5%



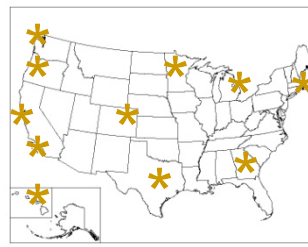
To do at other study sites:

- Assess use of V62.84 codes in injury/poisoning encounters
- ? Investigate complaint coding for telephone consulting nurse encounters
- Review sample of full-text records to assess PPV or case confirmation rate



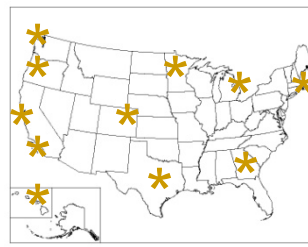
General lessons:

- Examine consistency across time and place
- Understand the technical and social environments where data are created



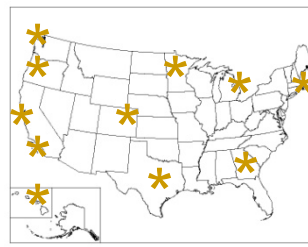
Next question:

Do we have an accurate test or procedure for identifying outpatients at increased risk of suicide attempt?



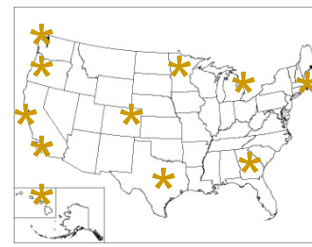
Screening for suicide risk

- Some evidence that self-report measures agree with clinical assessments
- But no evidence that self-report measures predict behavior
- USPSTF does not recommend screening

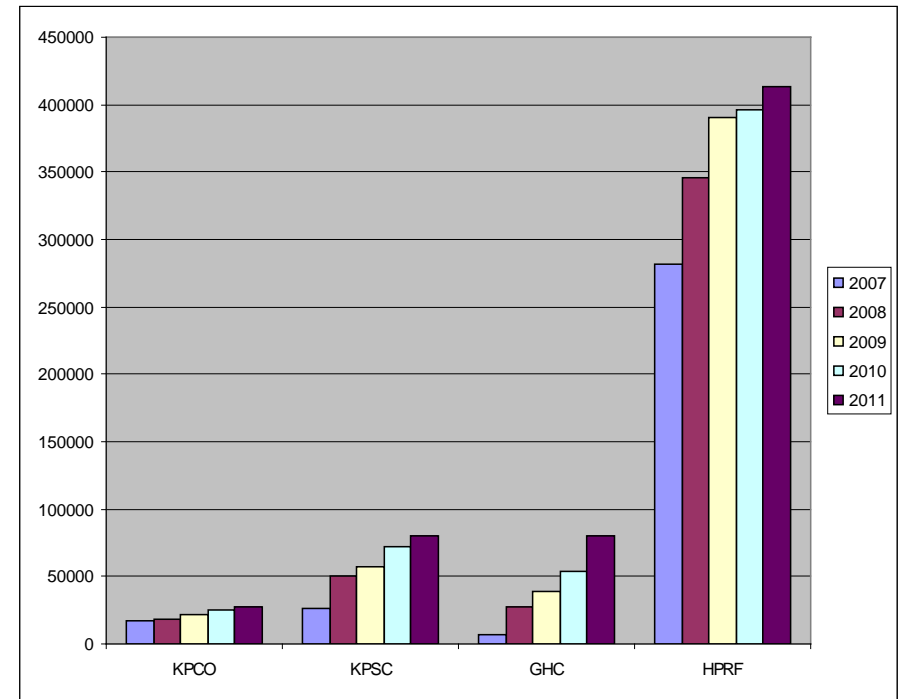
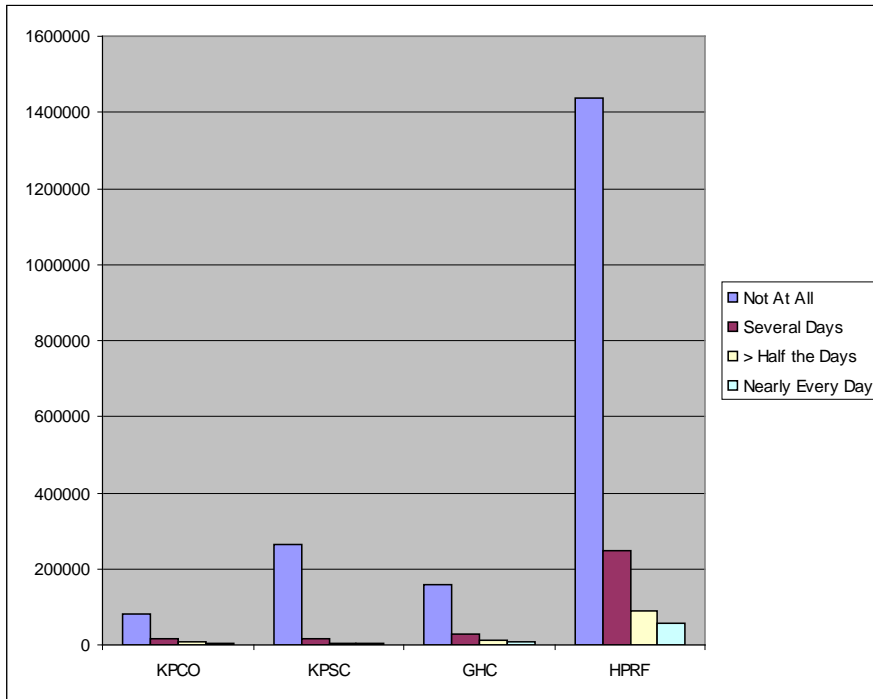


PHQ9 depression questionnaire

- “Industry standard” outcome measure for depression care
- Recommended for all depression care visits in large health care systems
- Item 9 asks about “Thoughts you would be better off dead or thoughts of hurting yourself in some way”

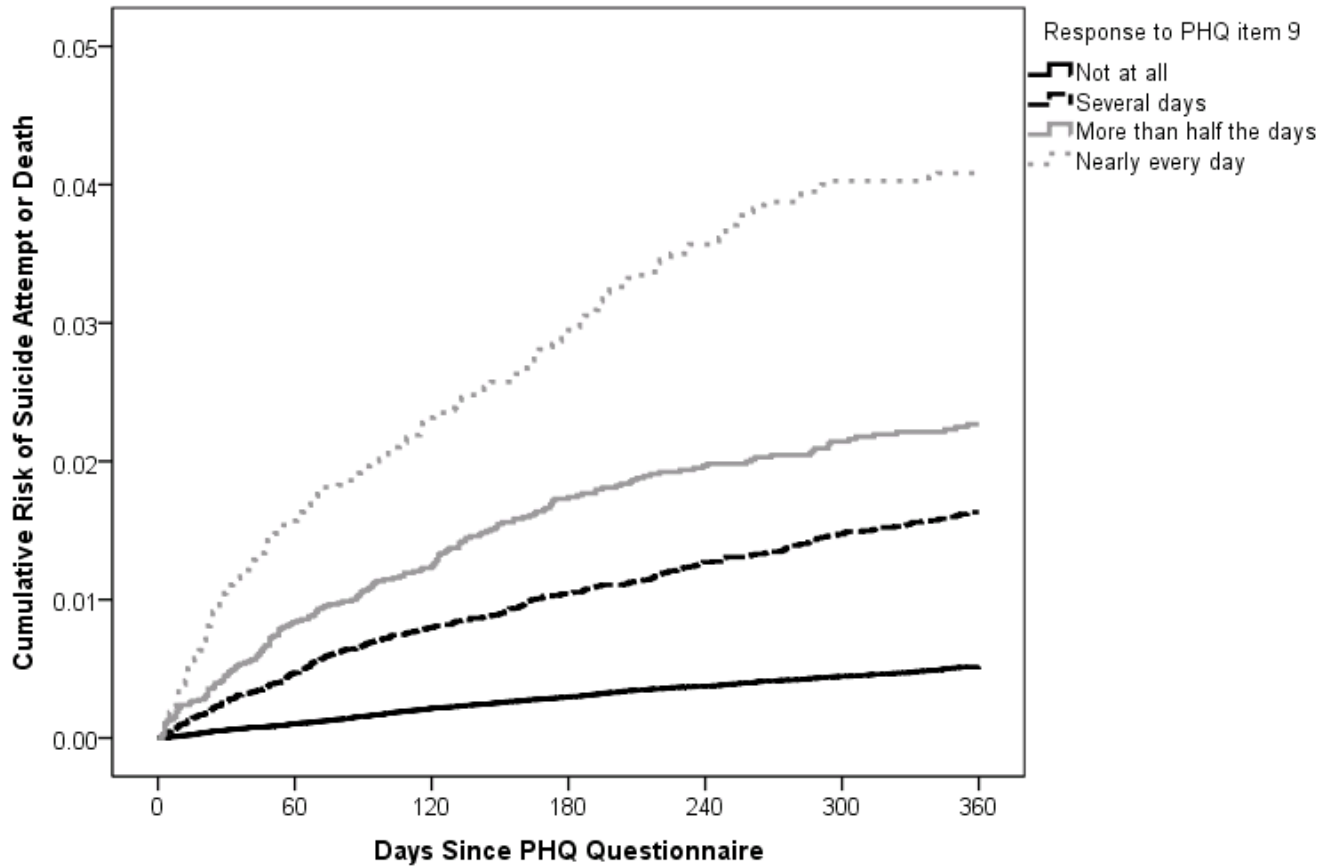


Trends in use of PHQ9



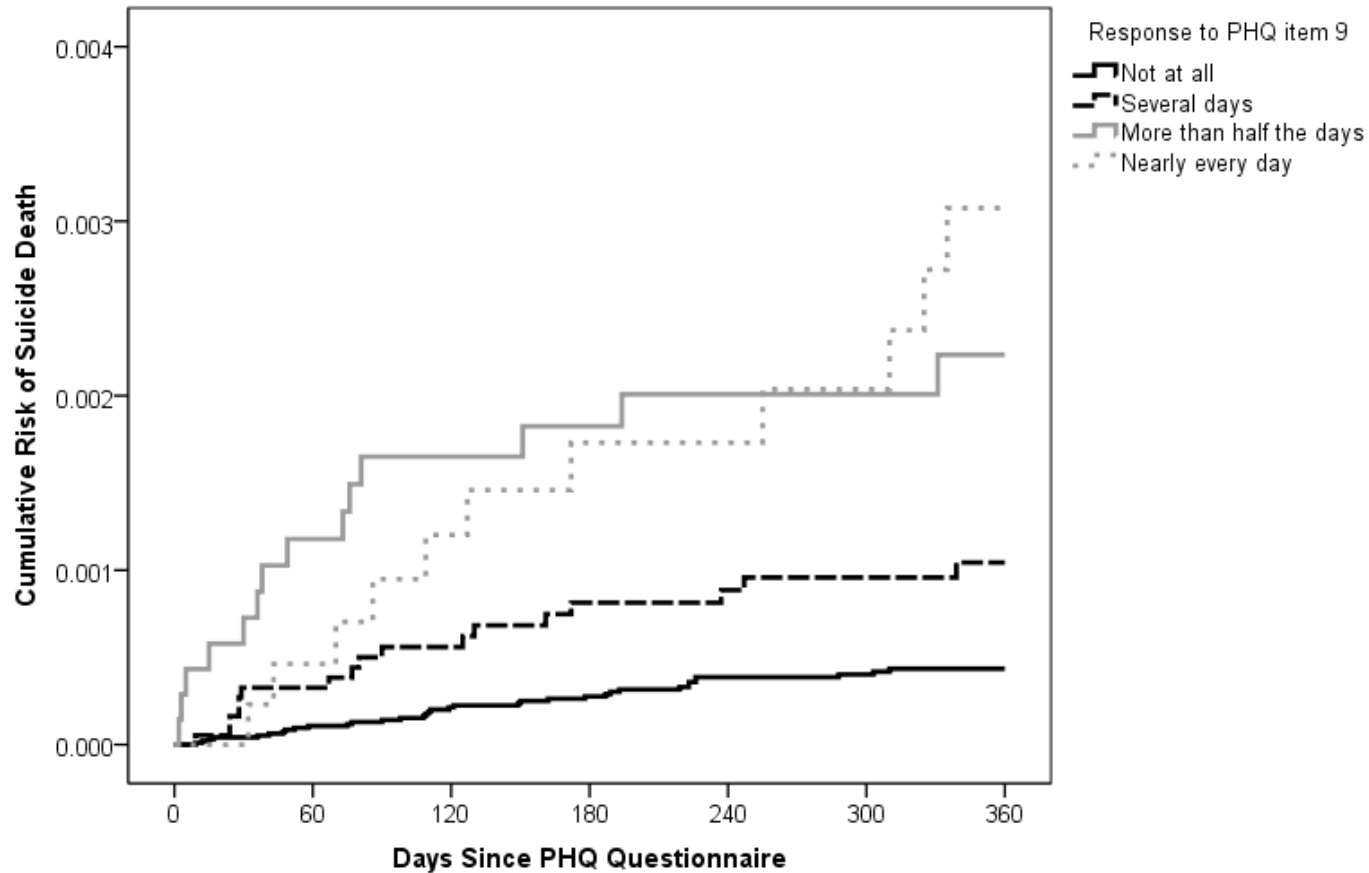


Risk of suicide attempt by PHQ Item 9 score





Risk of suicide death by PHQ Item 9 score





Balancing PPV against Sensitivity: Score on PHQ Item 9

	% of observations	Simple risk	% of attempts	Sensitivity if \geq	PPV if \geq
0	77%	0.6%	47%	100%	0.9%
1	14%	1.6%	22%	53%	1.8%
2	5%	2.2%	15%	31%	3.0%
3	4%	4.1%	16%	16%	4.1%

Could we do better?



PHQ ITEM 9 SCORE		
Not at all	1	1
Several days	2.8	2.1
More than half the days	4.1	2.7
Nearly every day	6.4	3.9
FEMALE		1.1
AGE		
13 thru 17		1
18 thru 29		0.6
30 thru 44		0.4
45 thru 64		0.3
65 or older		0.1
HISTORY OF SPECIALTY MENTAL HEALTH TREATMENT		1.8
HISTORY OF PSYCHIATRIC HOSPITALIZATION		3.9
TOTAL SCORE FOR PHQ ITEMS 1 THRU 8		
0 thru 4 (minimal)		1
5 thru 9 (mild)		1.2
10 thru 14 (moderate)		1.3
15 or more (severe)		1.6



Balancing PPV against Sensitivity: “Seat of the pants” risk score

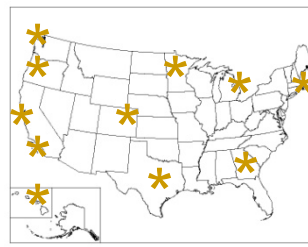
- 0 to 3 points for score on PHQ item 9
- 1 point for history of MH specialty treatment
- 2 points for history of inpatient MH treatment
- 1 point for score on PHQ items 1 thru 8 ≥ 20

Range 0 to 7



Balancing PPV against Sensitivity: Using Risk Score

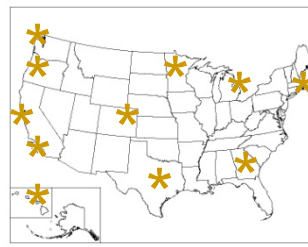
Risk Score*	% of observations	Simple risk	% of attempts	Sensitivity if \geq	PPV if \geq
0	31.8%	0.2%	7.6%	100%	0.9%
1	41.7%	0.6%	28.8%	92.4%	1.2%
2	11.9%	1.2%	15.0%	63.6%	2.2%
3	8.5%	2.3%	20.9%	48.6%	3.0%
4	3.7%	3.5%	14.1%	27.7%	4.1%
5	1.7%	4.0%	7.5%	13.6%	5.1%
6	0.4%	8.1%	3.7%	6.1%	7.9%
7	0.3%	7.7%	2.4%	2.4%	7.7%



NNT according to risk level in usual care (assuming 25% relative risk reduction)

Risk in control group	Risk in intervention group	NNT to prevent one suicide attempt	Total sample needed for 80% power
1%	0.75%	400	42,000
2%	1.5%	200	21,500
4%	3%	100	11,500
8%	6%	50	5,000
20%	15%	20	1800

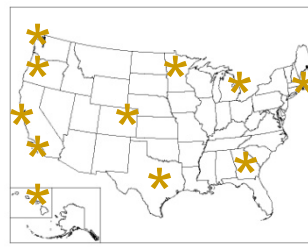
How do we select a threshold?



Cost acceptability criterion for selecting risk threshold

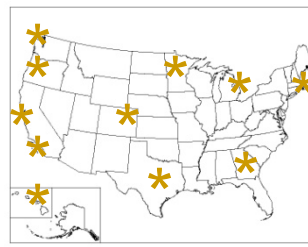
- Incremental cost per person
- Number needed to treat to avoid one event
- Willingness to pay to avoid one event

$$\text{NNT} = \text{WTP} / \text{Cost per person}$$



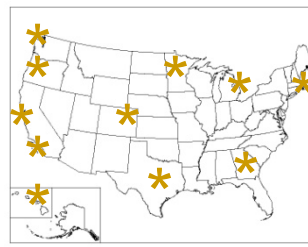
Selecting a willingness-to-pay threshold

- Direct health services cost for ER or inpatient treatment for suicide attempt = \$8000
- No existing estimates of indirect cost (lost productivity, family burden, etc). Assume \$1600



Anticipated cost of prevention programs:

- Risk assessment and care management intervention
 - Assume average of 6 outreach contacts over 1 year
 - Assume 60% of contacts by online messaging (\$12 each) and 40% by phone (\$28 each)
 - Estimated per-person cost = \$110
- Emotion regulation skills training program
 - Assume average of 4 outreach contacts over 1 year
 - Assume 60% of contacts by online messaging (\$12 each) and 40% by phone (\$28 each)
 - Estimated per-person cost = \$75



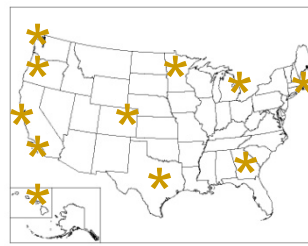
Therefore:

$$\begin{aligned}\text{NNT threshold} &= \text{WTP} / \text{Cost per person} \\ &= \$9600 / \$75 \text{ to } \$110 \\ &= 87 \text{ to } 128\end{aligned}$$

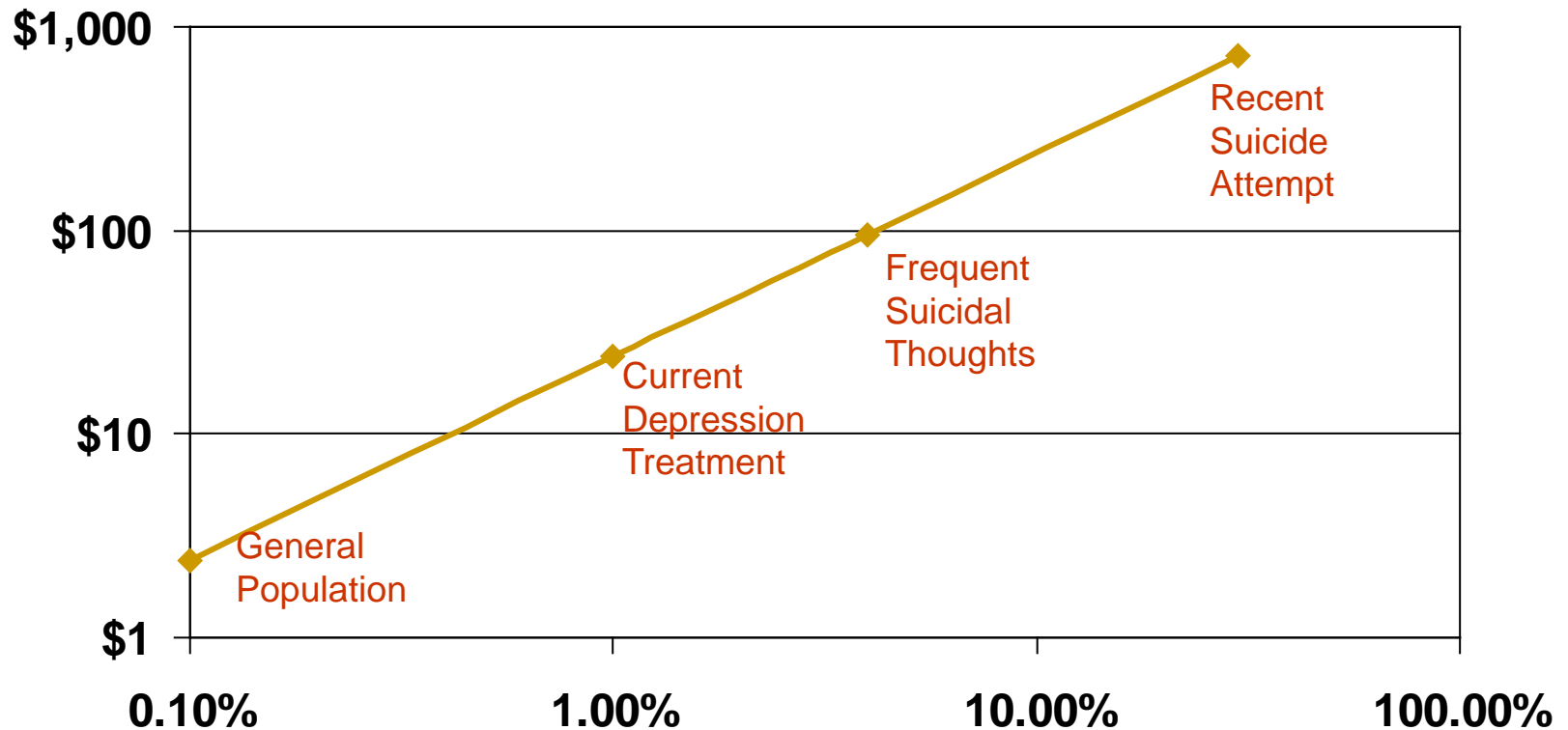


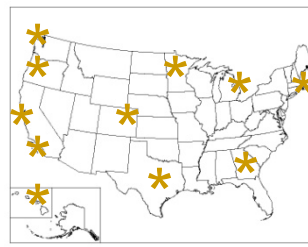
Risk score threshold based on WTP threshold

Risk Score*	% of observations	Simple risk	% of attempts	Sensitivity if \geq	PPV if \geq
0	31.8%	0.2%	7.6%	100%	0.9%
1	41.7%	0.6%	28.8%	92.4%	1.2%
2	11.9%	1.2%	15.0%	63.6%	2.2%
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4	3.7%	3.5%	14.1%	27.7%	4.1%
5	1.7%	4.0%	7.5%	13.6%	5.1%
6	0.4%	8.1%	3.7%	6.1%	7.9%
7	0.3%	7.7%	2.4%	2.4%	7.7%



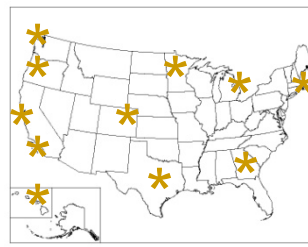
Summary: Intervention cost threshold by risk level





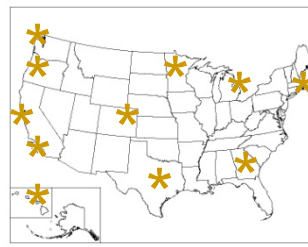
Sensitivity seems the bigger problem

Risk Score*	% of observations	Simple risk	% of attempts	Sensitivity if \geq	PPV if \geq
0	31.8%	0.2%	7.6%	100%	0.9%
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2	11.9%	1.2%	15.0%	63.6%	2.2%
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5	1.7%	4.0%	7.5%	13.6%	5.1%
6	0.4%	8.1%	3.7%	6.1%	7.9%
7	0.3%	7.7%	2.4%	2.4%	7.7%



Suicide attempts soon after completing PHQ9

Item 9 Score	# of PHQ Questionnaires	Any Suicide Attempt		
		Within 7 Days	Within 15 Days	Within 30 Days
Not at all	159,234	21	43	82
Several days	29,910	22	43	70
More than half the days	10,864	20	28	59
Nearly every day	7,257	20	40	84
Total	207,265	83	154	295

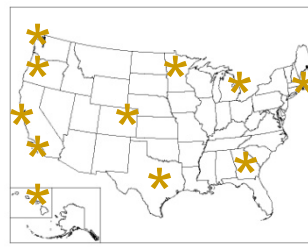


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Total	207,265	83	154	295

Unexpected

Expected



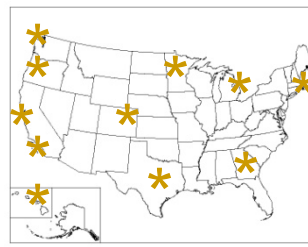
Unexpected vs. “expected” suicide attempts

No difference in:

- Age
- Sex
- Site of care (primary care vs. specialty mental health)

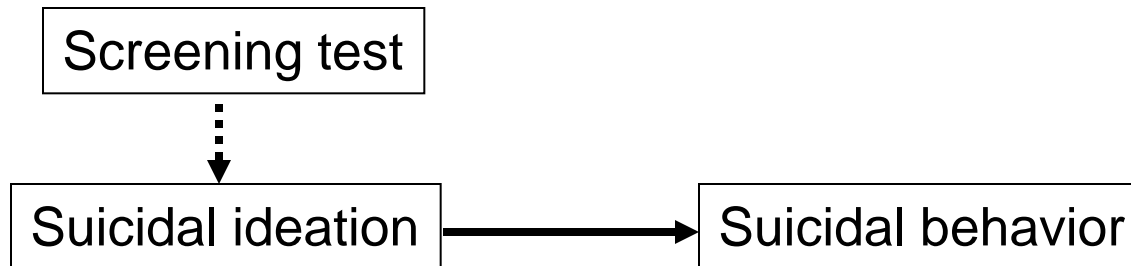
Less severe depression (measured by other items of PHQ depression scale)

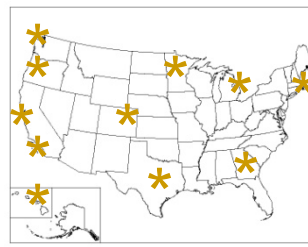
Still to look at: race/ethnicity, violent vs. nonviolent suicide attempts



Two reasons for low sensitivity:

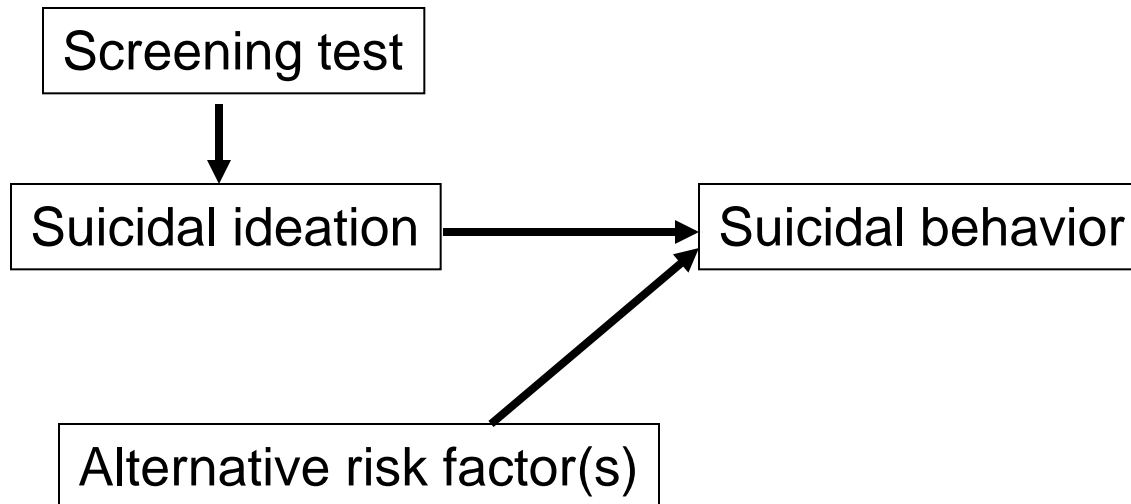
1) Our test does not detect suicidal ideation

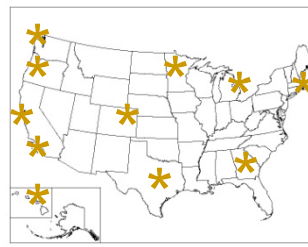




Two reasons for low sensitivity:

2) There is another causal pathway

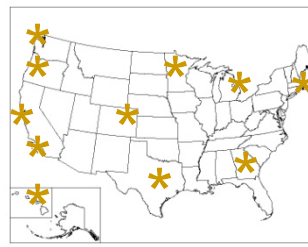




Could we identify “covert” suicidal thoughts?

Nock et al, *Psychol Sci.* 2010 Apr;21(4):511-7

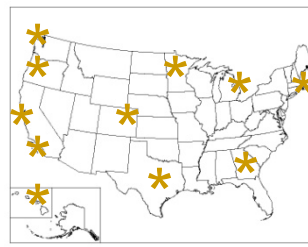
Implicit Association Test (IAT) measuring automatic (but unconscious) Associations between “self” and “death” predicted 6-fold higher risk of subsequent suicide attempt among people seeking treatment in a psychiatric emergency department.



Exploring alternative causal pathways

Possible add-on study:

- Prospective identification of “unexpected” suicide attempts
- Interview soon after event to assess:
 - Suicidal ideation prior to event
 - Preparatory actions
 - Intent



Closing thought: Acting despite uncertainty

- We need more sensitive measures of risk
- We can only evaluate those measures in very large samples (200,000 or more)
- This is only possible if measures are implemented by large health systems
- But those measures may prove inaccurate
- This requires a different relationship between research and practice