Risk Assessment and Categorization

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PROBLEM.

Given the number of times in which an unknown event has happened and failed: *Required* the chance that the probability of its happening in a ſingle trial lies ſomewhere between any two degrees of probability that can be named.

Bayes' Theorem

$$P(A|B) = \frac{P(B|A)\ P(A)}{P(B)}$$

Risk Assessment and Categorization

1. What are Risk Assessment and and Categorization
2. How good is optimal risk categorization
3. What is better short term or long term
4. How to assess for diverse outcomes
5. Contextualizing risk categorization with its consequences

Risk Assessment

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- Male sex

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- Male sex
- Over 60

Risk Assessment

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- Divorced

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Risk Assessment

- Male sex
- Over 60
- Divorced
- Any psychiatric history

Risk Assessment

- Male sex
- Over 60
- Divorced
- Any psychiatric history
- Suicide ideas

Risk Assessment

- Male sex
- Over 60
- Divorced
- Any psychiatric history
- Suicide ideas
- Significant illness

Risk Assessment

- Male sex = 4 times risk
- Over 60 = 2 times risk
- Divorced = 1.5 times risk
- Any psychiatric history = 5 times risk
- Suicide ideas = ??? = 1.5 times risk
- Significant illness = 1.5 times risk

Risk Categorization

- 4 or more we define as a high risk category
- Probably confers an odds of suicide of about 6
- What does this actually mean?

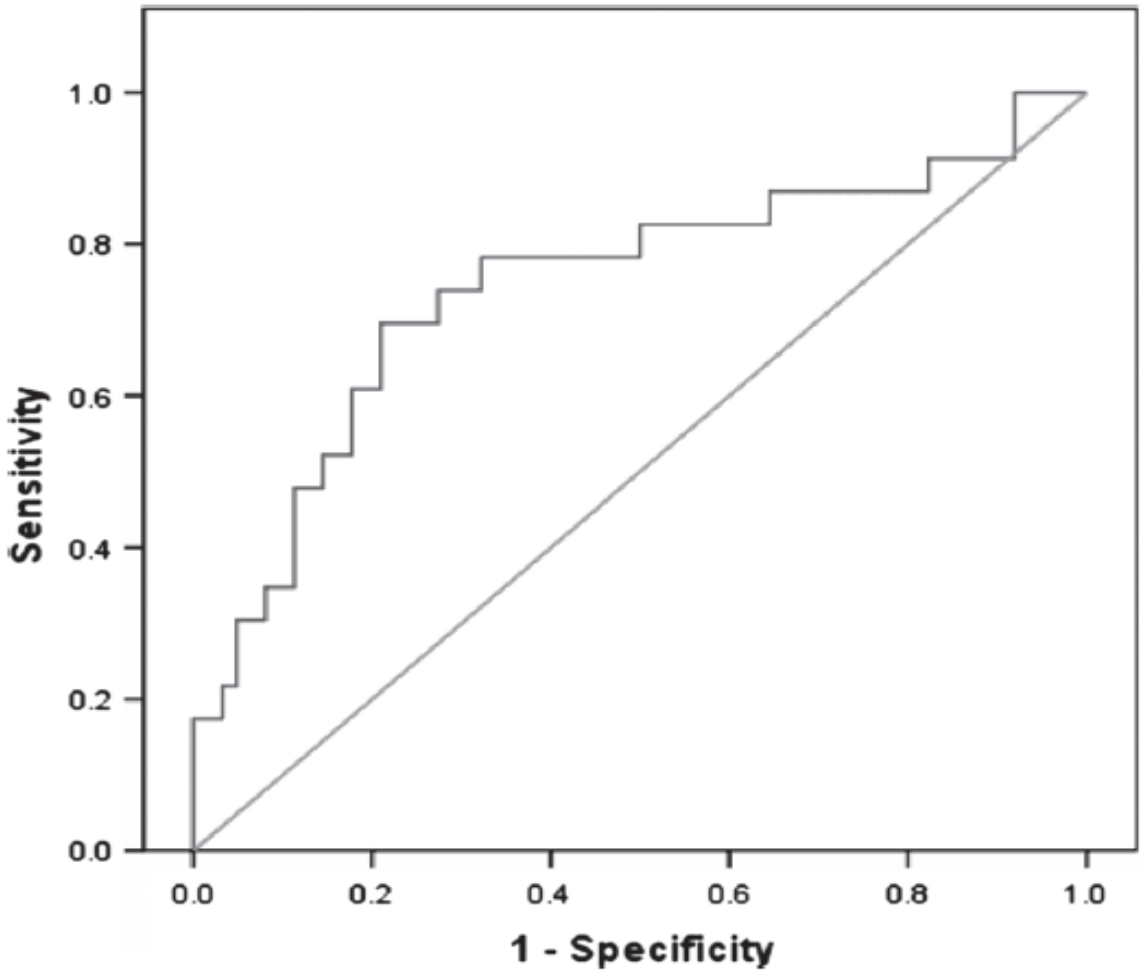
Part 2 Risk Categorization

	Low Risk	High risk
No suicide	True negative	False Positive
Suicide	False negative	True Positive

Definitions

Metric	Definition
Incidence	Proportion of cases per unit time
Sensitivity	Proportion of violent cases classified as high risk
Specificity	Proportion of non-violent cases classified as low risk
Positive Predictive Value	Proportion of high risk cases becoming violent
Odds ratio	Increased likelihood of violence in the high risk group when compared to the low risk group

Sensitivity Versus Specificity



Annual incidence of adverse events in schizophrenia

Adverse event	Annual incidence
Any violence	10-30%
Any self-harm	10%
Criminal violence	1-4%
Suicide	0.5-1%
Homicide	1 in 10,000
Homicide of a stranger	1 in 140,000

The Predictive Value of Risk Categorization in Schizophrenia

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Background: Risk assessment is increasingly used to inform decisions regarding the psychiatric treatment of patients with schizophrenia and other serious mental disorders. *Aims:* To examine the theoretical limits of risk assessment and risk categorization as applied to a range of harms known to be associated with schizophrenia. *Methods:* Using known rates of suicide, homicide, self-harm, and violence in schizophrenia, a hypothetical tool with an unrealistically high level of accuracy was used to calculate the proportion of true- and false-positive risk categorizations. *Results:* Risk categorization incorrectly classified a large proportion of patients as being at high risk of violence toward themselves and others. *Conclusion:* Risk assessment and categorization have severe limitations. A large proportion of patients classified as being at high risk will not, in fact, cause or suffer any harm. Unintended consequences of inaccurate risk categorization include unwarranted detention for some patients, failure to treat others, misallocation of scarce health resources, and the stigma arising from patients' being labeled as dangerous. (HARV REV PSYCHIATRY 2011;19:25–33.)

Keywords: homicide, risk assessment, schizophrenia, self-harm, suicide, violence

Hypothetically Excellent Risk Assessment Tool (HEART)

- 80% sensitivity, 80% specificity
- Superior to the MacArthur risk assessment instrument 75% and 75%

Common event 20% incidence of Any violence

	Low Risk	High risk
No violence = 800	640	160
Any violence = 200	40	160

How well does the HERAT perform for a common event , Any Violence

- Correctly classified cases = 80%
- Misses cases = 20%
- Odds of violence in high risk group= (160/320)/(40/680) = 8.5
- Proportion of violent in high risk =50%
- Number High Risk needed = 2

Uncommon event 2% - arrest for violence

	Low Risk	High risk
No Arrest for violence = 980	784	196
Arrest for Violence = 20	4	16

How well does the HERAT perform with an uncommon event such as Arrest for Violence

- Correctly classified cases = 80%
- Missed cases = 20%
- Odds of violence in high risk group
  = (16/196)/(4/748) = 15
- Proportion of violent in high risk =7.5%
- Number High risk needed = 13

Rare event 1 in 10,000 - Homicide

	Low Risk	High risk
No Homicide = 99 990	79 992	19998
Homicide = 10	2	8

How well does the HERAT perform with a rare event such as Homicide

- Correctly classified cases = 80%
- Missed cases = 20%
- Odds of violence in high risk group
  = (8/20 006)/(2/79994) = 16
- Proportion of violent in high risk =.04%
- Number high risk needed = 2500

Summary

	Incidence	Missed cases	Correct classifications	Number high risk needed
Any violence	20%	20%	50%	2
Arrest for violence	2%	20%	7.5%	13
Homicide	1 in 10,000	20%	0.04%	25,000
Stranger homicide	1 in 140,000	20%	.003%	35,000

Part 3. Short vs Longer term

Short term versus Long term

	Incidence of assault	Missed cases	Proportion violent in high risk groups	Number needed to assess
1 week	.4%	20%	1.6%	62
1 month	1.7%	20%	6%	17
6 months	10%	20%	30%	3
1 year	20%	20%	50%	2

Part 3. Violence versus Self Harm 1

Table 1. Risk factors reported for inpatient suicide and aggression

	Inpatient aggression	Inpatient suicide — Odds ratios	Direction of effect sizes
Age	−0.32*	1.08	Opposite
Male sex	1.1	1.2	Same
Married	0.72	1.08	Opposite
Affective diagnosis	0.94	1.93	Opposite
Schizophrenia diagnosis	1.16	2.48	Same
Involuntary admission	2.17	1.87	Same
Prior self-harm	1.24	3.95	Same
Prior violence	2.27	0.93	Opposite
Substance use	2.09	0.70	Opposite

Violence versus self harm II

Table 1. Effect size and relative effect size directions of factors associated with violence and self-harm in first episode psychosis as determined by meta-analysis.

	Odds ratios		Effect size direction
	Violence	Self-harm	
Age	0.54[a]	0.57[a]	Same
Alcohol use	1.43	1.68[a]	Same
Depressed mood	0.57[a]	2.61[a]	Opposite[b]
Drug use	2.33[a]	1.46[a]	Same
Duration of untreated psychosis	1.56[a]	1.45[a]	Same
Involuntary treatment	3.84[a]	0.79	Opposite[b]
Less education	1.99[a]	1.38[a]	Same
Less insight	1.31	0.61[a]	Opposite[b]
Male	1.61[a]	0.85	Opposite[b]
Negative symptoms	0.82	1.20	Opposite
Positive symptoms	1.20	1.05	Same
Schizophrenia	1.02	0.92	Opposite
Self-harm	1.22	3.94[a]	Same

[a]Statistically significant with a p-value > 0.05 as determined by meta-analysis.
[b]Statistically significant opposite effect sizes as determined by confidence intervals.

Self Harm Vs Violence

- Not possible to optimally assess for these two feared outcomes.

Part 5. Contextualizing risk assessment

- Rare events are always associated with a low proportion of cases in high risk groups
- Therefore, any treatment instigated on the basis of risk assessment needs to be benign, so as to be acceptable to false positives
- In the real world, low risk patients make up 50% of adverse cases
- Why then not provide the benign treatment to all.

What do these men have in common

- Niels Bohr
- Winston Churchill
- Albert Einstein
- Benjamin Disreali
- Enrico Fermi
- Groucho Marx
- George Bernard Shaw
- Mark Twain

all are thought to have said….

Prediction is very difficult,

especially about the future.

Solution

- Treat risk factors irrespective of overall risk category
- Treat current harm on an urgent basis
- Abandon risk categorization as a way of allocating resources
- Delete risk criteria from mental health laws
- Move to capacity based laws