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Predicting Gambling-Related Problems among Internet Gamblers

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Behavioral Markers for Gambling Problems

What are biomarkers?

- A characteristic that is objectively measured and evaluated as an indicator of normal biologic processes, pathogenic processes, or pharmacologic responses to a therapeutic intervention (Biomarkers Definitions Working Group, NIH, 2001)

What are biomarkers?

- Underlying physiological process—which results from a disease state or contributes to a disease state—produces a change in a measurable biological characteristic
- Use biomarkers for early detection, diagnosis, classification of risk, and personalized selection of treatment

What are biomarkers?

■ Example: Cancer

- Using biomarkers to detect, diagnose, and manage disease
- Diagnose and treat cancer in its incipient stage
- Make early detection not only possible, but routine
- Use routinely during the processes of treatment selection and treatment management

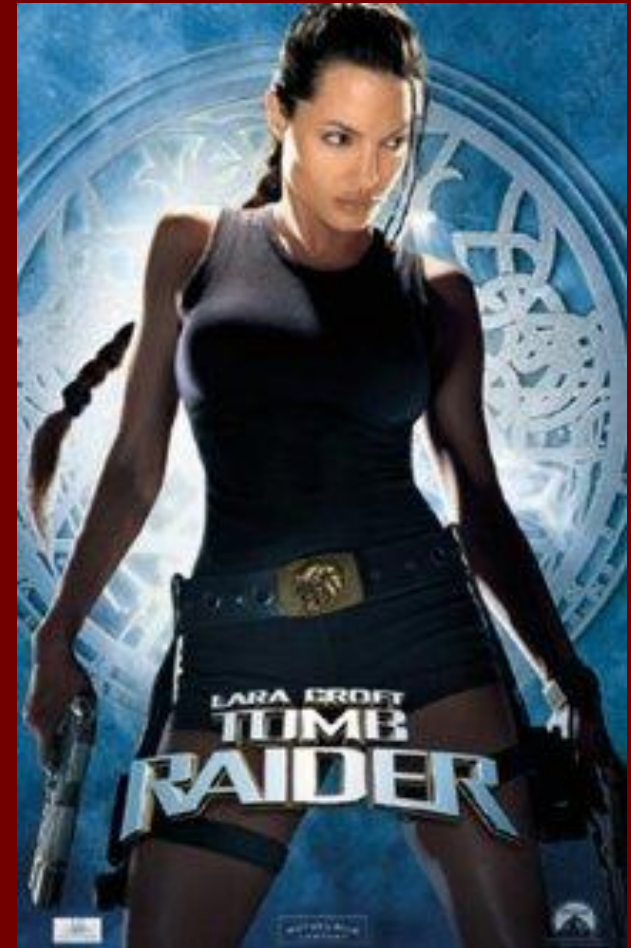
What are biomarkers?

- Detect *potential* for disease
 - BRCA1 - type of tumor-suppressing gene known as a cancer susceptibility gene
 - Mutations to BRCA1 are rare, but increase risk for breast cancer from about 12% to 60% or higher
 - Only 3-5% of women who have breast cancer have the mutation



What are biomarkers?

- Detect *potential* for disease
 - Mutation detected via blood test
 - Individuals w/ mutation can choose proactive intervention
- "My chances of developing breast cancer have dropped from 87 percent to under 5 percent." (Jolie)



What are behavioral markers?

- Similar to biomarker, except the underlying process is reflected in observable changes in behavior instead of biology

Translate into gambling/algorithm work

- Save time and resources and improve quality of life by intervening before clinical symptoms of disordered gambling appear.
- Need to identify the precursors (e.g., markers) to clinically manifest disordered gambling
- We can also use markers to track therapeutic change.

Internet Gambling: Risk and Resource?

- Internet Gambling provides unique opportunities for the study of gambling behavior and problems.
- Unlike land-based gambling, the very technology that makes Internet gambling a potential risk allows for the study of actual real-time gambling behavior.

Implementing a Marker Based Strategy

The Goal

- Use actual gambling behavior to identify, with good reliability and validity, distinct groups of gamblers among those who have gambling-related problems
- Utilize this/these algorithm(s) to set up an early warning system for players at risk of developing problems

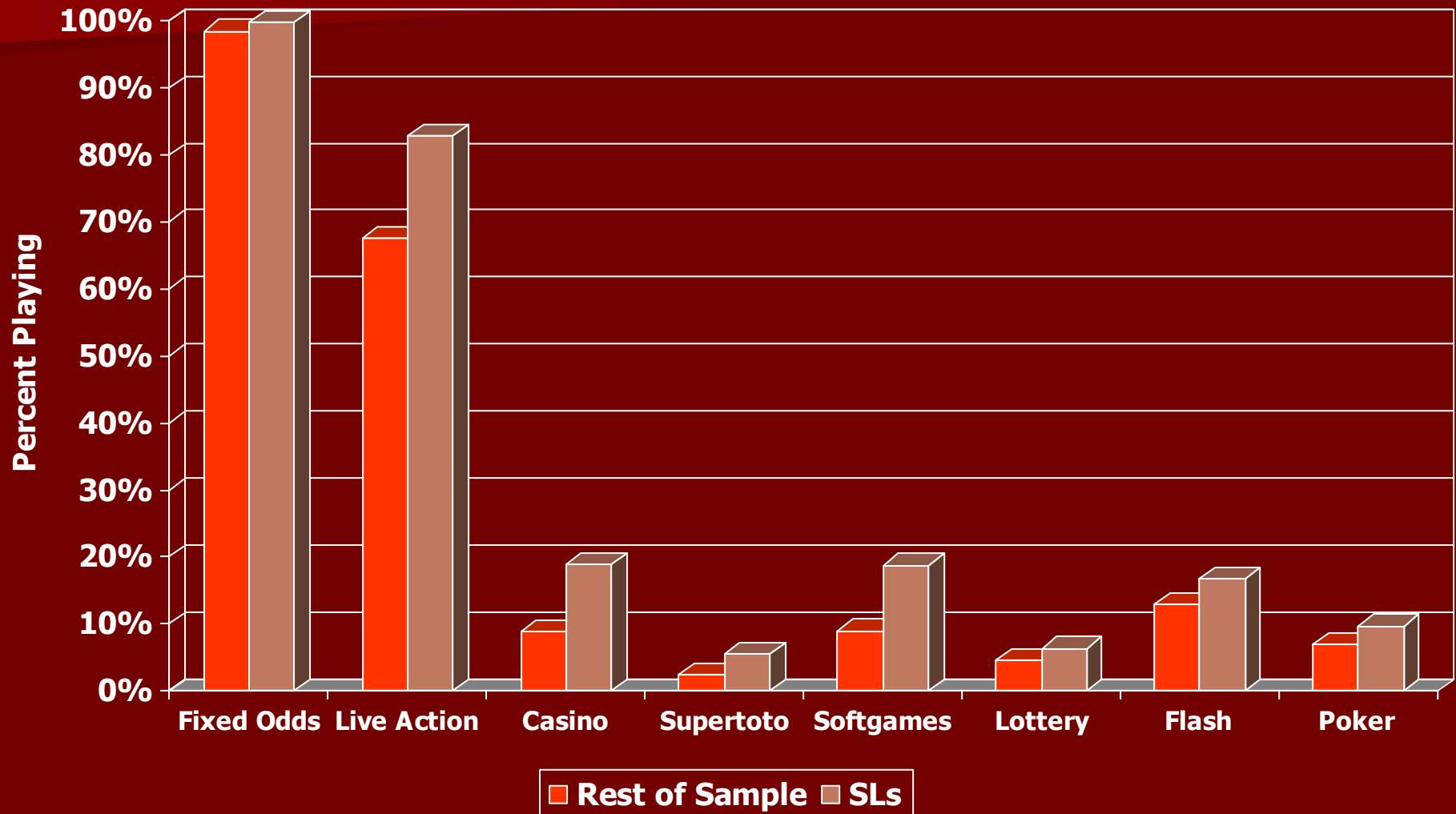
Potential Criterion Variables: Proxies for Gambling Problems

- Self-Limiters
- Account Closers
- Subscribers w/ RG (Responsible Gaming) Flags

Self-Limiters versus Others: Pre-limit Comparisons

- Limiters played a greater diversity of gambling games
- Limiters bet on more days within their active betting period
- Limiters placed more bets per day
- Limiters wagered less money per bet
- Limiters and others did not differ in terms of:
 - Total wagered, net loss, percent lost

Self-Limiters: Games Played



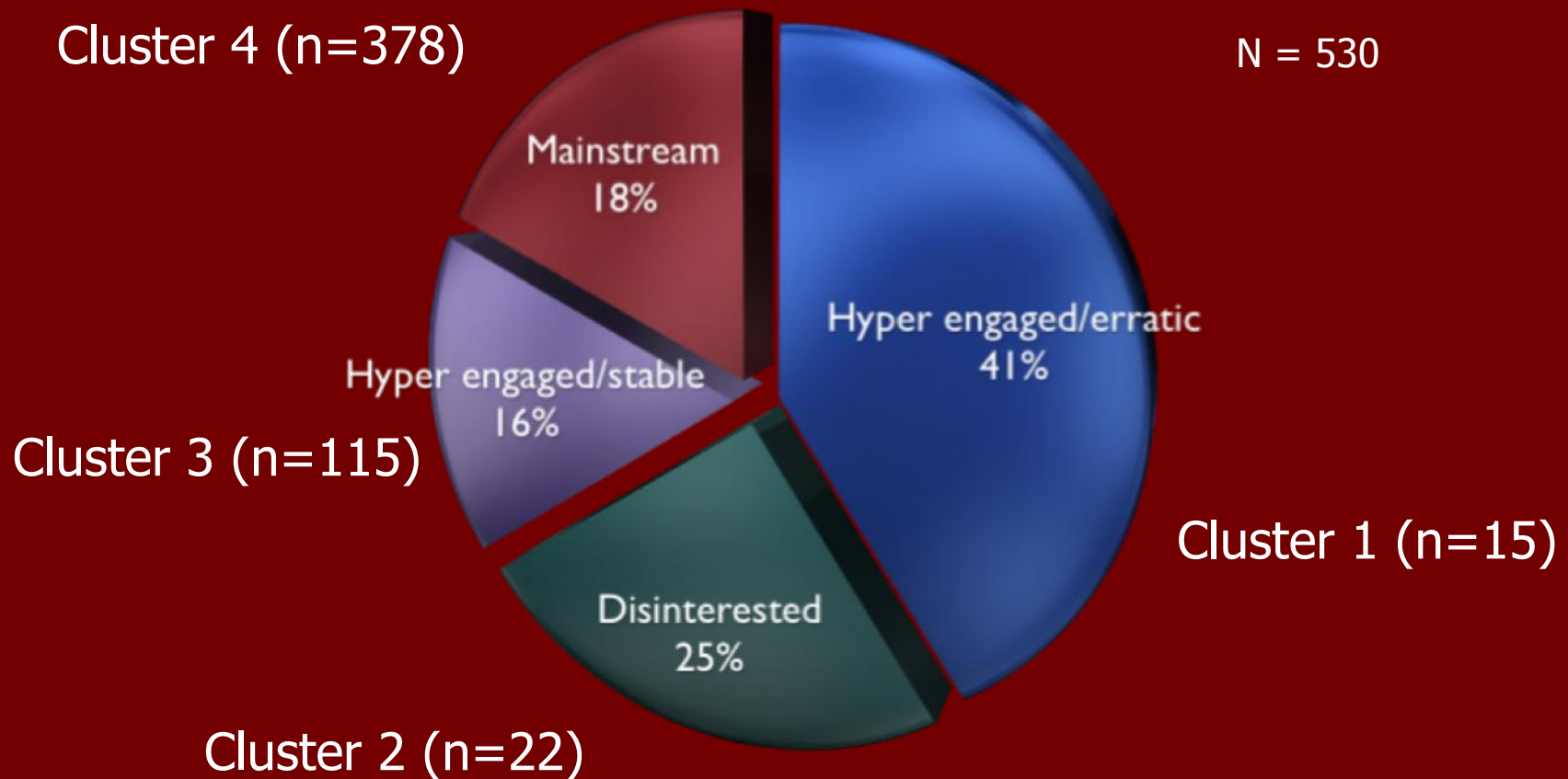
Sports Betting Account Closers

- Found a pure group of people who closed their accounts for gambling related reasons (when attempting to discriminate them from people closing their accounts because of loss of interest); these pure problem-gambling account closers were distinguished from non-pure problem-gambling account closers by their intensity (frequency, bets per day, high amount of bet, and # of active days).

Live Action Account Closers

- First 30 days of play
 - Four groups emerged
 - One small group was high on first month frequency, intensity, and variability, and had an increasing slope of wagers. This group had a high percent within it whose reason for account closing was gambling-related problems.

% of Subscribers Who Closed Their Accounts Due to Gambling-Related Problems Falling into Each Cluster



Cluster 1 significantly different from the other 3, $p < .01$; other 3 not different from each other.

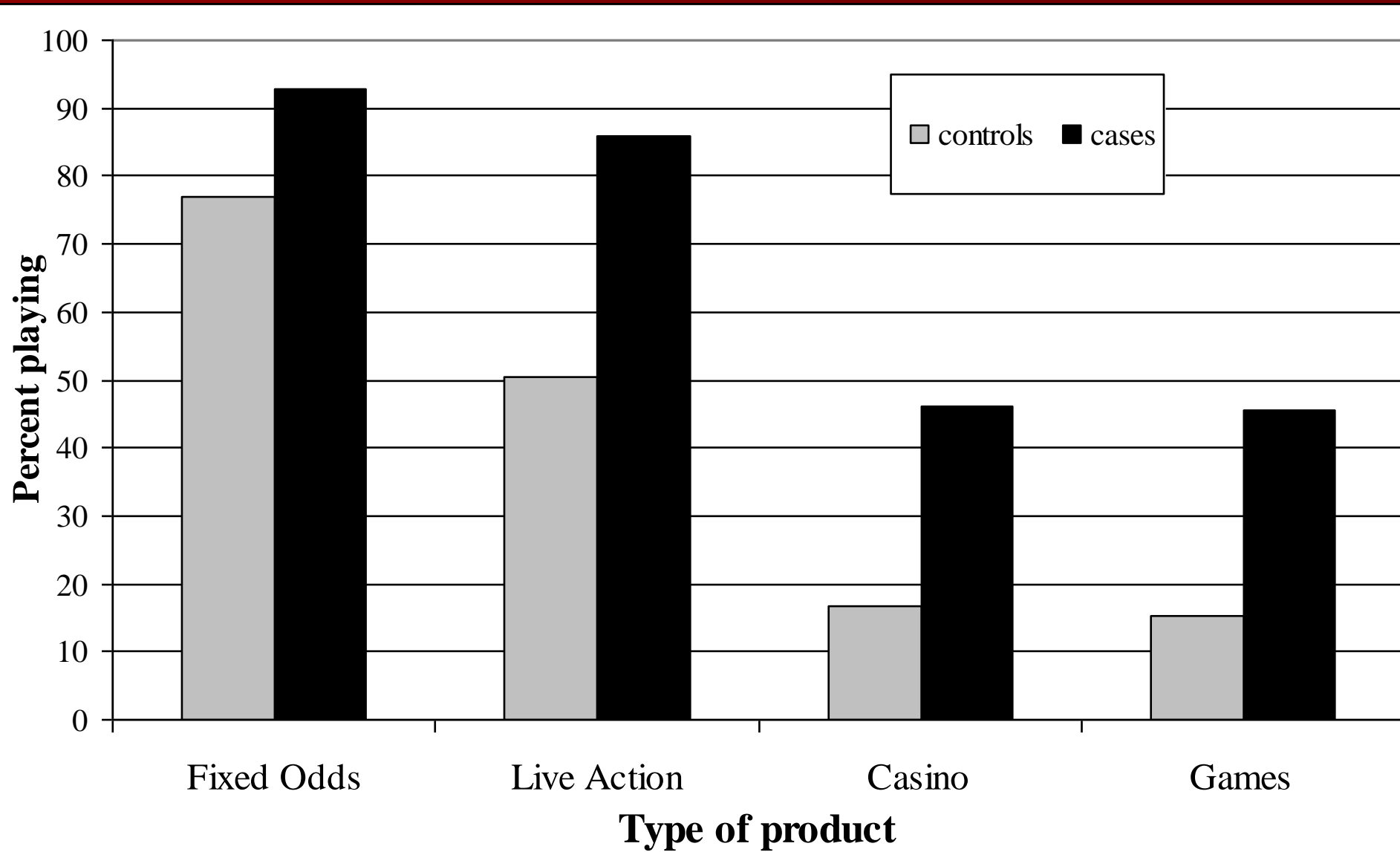
Live Action PG Account Closers

- Last 30 days of play
 - Greater stakes
 - Greater loss
 - Did NOT chase longer odds – chose more conservative bets than controls

Subscribers w/ RG Flags

- RGs played a greater diversity of gambling games
- RGs bet on *fewer* days within their active betting period
- RGs placed more bets per day
- RGs wagered more money per bet
- RGs had greater net losses, but lost less per bet

Subscribers w/ RG Flags



bwin.party Work to Date: Finding Overlap

- Activity level is important
- Involvement in multiple game types is associated with risk
- Idea of dispersion or variability is important
- Amount wagered may not be hugely important when divorced from level of activity
- *Maintaining* a high level of activity is a marker

Limitations of Criterion Variables

■ Self-Limiters

- Individuals recognize they have a problem or are at risk of having a problem
- Individuals might be acting preventively, not due to actual problems

■ Account Closers

- Individuals recognize they have a problem

■ RGs

- Heterogenous group identified by bwin.party

New Sample: BBGS

- Brief Bio-Behavioral Gambling Screen
 - 3 items from the DSM-IV PG Criteria that maximally discriminate PGs from others
 - Withdrawal: During the past 12 months, have you become restless, irritable, or anxious when trying to stop and (or) cut down on gambling?
 - Lying: During the past 12 months, have you tried to keep your family or friends from knowing how much you gambled?
 - Borrowing Money: During the past 12 months, did you have such financial trouble as a result of gambling that you had to get help with living expenses from family, friends, or welfare?

New Sample: BBGS

- Sent invitation to 100,000 bwin.party subscribers to complete the BBGS
 - Approximately 2% responded
- Final sample of 1,964
 - 73% endorsed no BBGS items
 - 17% endorsed 1 BBGS item
 - 8% endorsed 2 BBGS items
 - 2% endorsed 3 BBGS items

Developing an Algorithm - Approach

- Develop on one sample, validate on other
- Not time-dependent
- Initially working with samples that engage primarily in sports betting

Developing an Algorithm

- Tested three variations of five models, predicting to BBGS score of 1+ and 3+
 - Used discriminant function analysis
 - Examined sensitivity, specificity and PPV for each

Algorithm Characteristics

	Actual		
Estimated	<i>Positive</i>	<i>Negative</i>	Total
<i>Positive</i>	A (True Positive)	B (False Positive)	A+B (Estimated Positives)
<i>Negative</i>	C (False Negative)	D (True Negative)	C+D (Estimated Negatives)
Total	A+C (Actual Positives)	B+D (Actual Negatives)	N

- Sensitivity = Proportion of actual positives that are estimated as positive
 - $A / (A+C)$
- Specificity = Proportion of actual negatives that are estimated as negative
 - $D / (B+D)$
- Positive Predictive Value = Proportion of estimated positives that are actual positives
 - $(A / A+B)$

Developing an Algorithm

- Validated the model on additional sample
 - Reran the analysis in the RG sample
 - Tested the actual coefficients and cutpoints derived from the BBGS sample in the RG sample
- Validation resulted in same variables and similar sensitivity and specificity and PPV values in second sample

Developing an Algorithm

■ Key variables

- Frequency
- Games played
- Bets per day
- Variability (SD of wagers)
- Euros per bet

■ Equation

- Risk Level = $0.134 * \text{LNfreq} + 0.793 * \text{LNbpd} + 0.617 * \text{LNepb} - 0.27 * \text{LNvariance} + 1.177 * \text{LN\#games} - 2.442$

Developing an Algorithm

■ Best at predicting to 1+ BBGS

Classification Results^a

BBGS classification variable			Predicted Group Membership		Total
			no positive BBGS responses	at least 1 positive BBGS response	
Original	Count	no positive BBGS responses	894	467	1361
		at least 1 positive BBGS response	202	309	511
	%	no positive BBGS responses	65.7	34.3	100.0
		at least 1 positive BBGS response	39.5	60.5	100.0

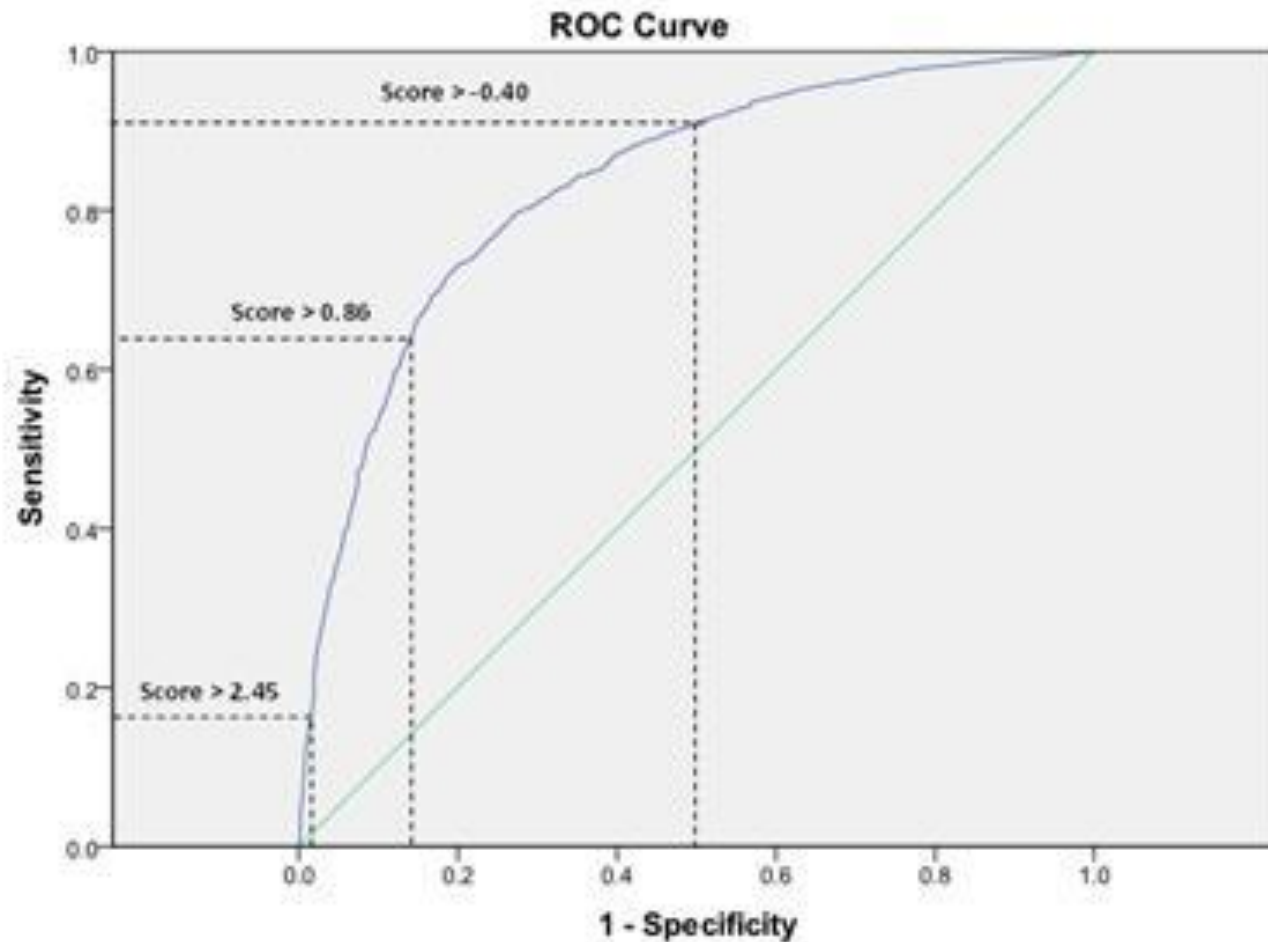
a. 64.3% of original grouped cases correctly classified.

- Sensitivity = $309/511 = 60.5\%$ of cases accurately identified
- Specificity = $894/1361 = 65.7\%$ of non-cases accurately identified
- Positive Predictive Value = $309/776 = 39.8\%$ of identified cases are actual cases

SportBettor Algorithm 1.1

- Risk Level = $0.134 * \ln(\text{frequency}) + 0.793 * \ln(\text{bets per day}) + 0.617 * \ln(\text{Euros per bet}) - 0.127 * \ln(\text{variance}) + 1.177 * \ln(\# \text{ of games played past 12 mo.}) - 2.442$
- Gives us a continuous “risk” score
- Cut points are not set in stone

Developing an Algorithm



AuC=0.83

Developing an Algorithm

- Selecting a lower cut point results in more false positives, and fewer false negatives.
- Selecting a higher cut-point will result in fewer false positives (i.e., fewer people who really do not have problems being told they might have problems), and more false negatives (i.e., more people who do have problems but do not receive flags).

Developing an Algorithm

- Tiered Approach
 - Tier 1: High sensitivity, low specificity
 - Tier 2: Maximize both
 - Tier 3: Maximize specificity

So You Have an Algorithm... Now
What?

To consider

- Interventions tailored to each tier
 - Beware unintended consequences



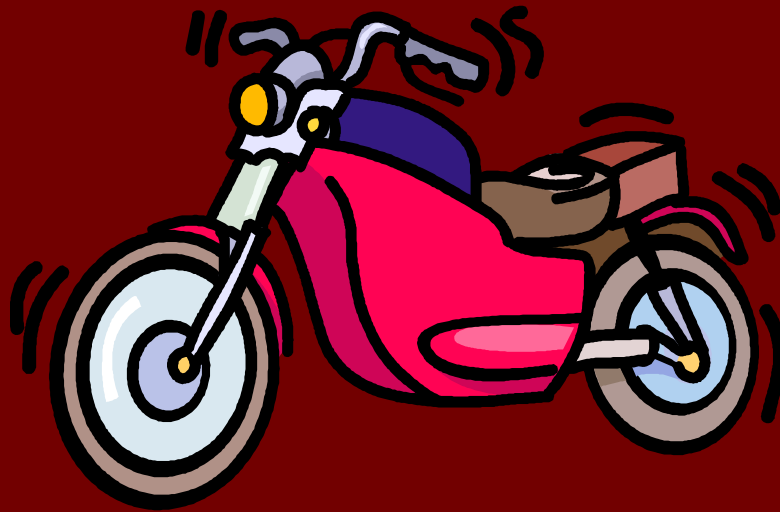
“About 70% of women in the United States who have both breasts removed after a cancer diagnosis don't have a proven medical reason for undergoing the procedure” (Gilbert, CNN, May 2013)

To consider

- AA Model or Harm Reduction
 - Dynamic risk

To consider

- Self-help vs. forced-help
 - Live free or/and die?



General Limitations

- Platform-specific
- Do not know about disposable income
- First step – sensitivity and specificity are not all that good
- Behavioral data is valuable but has its own limitation – best if we can integrate behavioral and psychosocial data
- **Constrained to the variables we have thought to test**

The Transparency Project

- Public data repository for privately-funded datasets, such as industry-funded data
- Currently hosts several bwin.party data sets
- Anyone can contribute to the repository or use data from the repository
- www.thetransparencyproject.org

Additional Resources

- www.divisiononaddiction.org
 - Division on Addiction's main website
 - Current projects and publications
- www.basisonline.org
 - Brief science reviews and editorials on current issues in the field of addictions (gambling, alcohol, tobacco, illicit drugs, addictions & the humanities)
 - Addiction resources available, including self-help tools
- www.thetransparencyproject.org
 - Public repository of privately-funded addiction datasets
 - Includes datasets from bwin.party, used in the studies cited today
- snelson@hms.harvard.edu
 - Email me if you have any questions

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