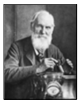
Addressing the Cyber Language Barrier

Measuring and Communicating Cyber Risk More Effectively

> *"When you can measure what you are speaking about and express it in numbers, you know something about it."* - Lord Kelvin



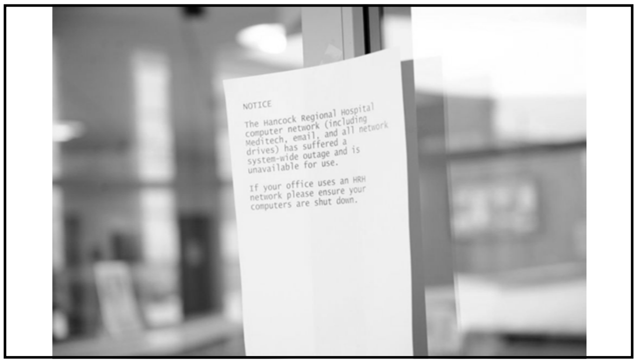
Disclaimer:

I am not a lawyer

This is not legal advice

Is Cyber Security an ^ Issue?

Business & Healthcare

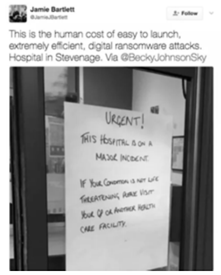


NOTICE

The Hancock Regional Hospital computer network (including Meditech, email, and all network drives) has suffered a system-wide outage and is unavailable for use.

If your office uses an HRH network please ensure your computers are shut down.

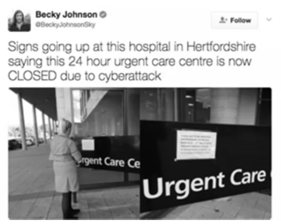
NHS



Jamie Bartlett
@JamieJBartlett

This is the human cost of easy to launch, extremely efficient, digital ransomware attacks. Hospital in Stevenage. Via @BeckyJohnsonSky

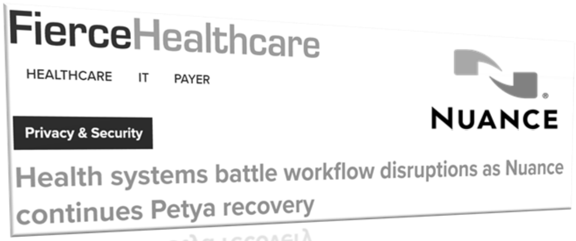
URGENT!
THIS HOSPITAL IS ON A MAJOR INCIDENT.
IF YOUR CONDITION IS NOT LIFE THREATENING PLEASE VISIT YOUR GP OR ANOTHER HEALTH CARE FACILITY.



Becky Johnson
@BeckyJohnsonSky

Signs going up at this hospital in Hertfordshire saying this 24 hour urgent care centre is now CLOSED due to cyberattack

Production shutdown resulted in $240M in lost sales



FierceHealthcare

HEALTHCARE IT PAYER

Privacy & Security

NUANCE

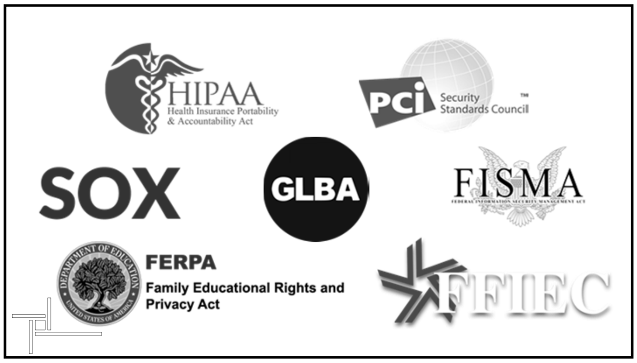
Health systems battle workflow disruptions as Nuance continues Petya recovery

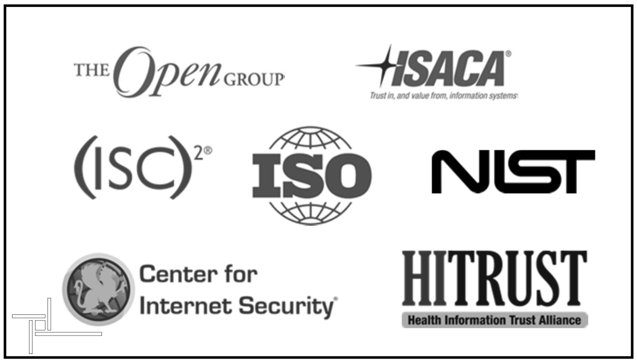
Adjusted Q3 revenue from $510M to $494M

Organization	Estimated Cost	Year
Epsilon	$4 Billion	2011
Veterans Administration	$500 Million	2006
Merck	$275 Million	2017
Hannaford Bros	$252 Million	2007
Sony PlayStation	$171 Million	2011
Target	$162 Million	2013
TJ Maxx	$162 Million	2007
Heartland Payment	$140 Million	2008
Anthem	$100 Million	2015
Sony Pictures Entertainment	$100 Million	2014
Home Depot	$56 Million	2014

$2.1 Trillion

Cost of cyber crime by 2019 – Juniper Networks


HIPAA
Health Insurance Portability & Accountability Act
PCI Security Standards Council
SOX
GLBA
FISMA
FERPA
Family Educational Rights and Privacy Act
FFIEC


THE Open GROUP
ISACA
Trust in, and value from, information systems
(ISC)²
ISO
NIST
Center for Internet Security
HITRUST
Health Information Trust Alliance

$231.94 Billion

Cyber Security Market by 2022

Houston,
we DON'T have an IT
problem.

Objective

Strategy

Part 1: Common Analysis Methods

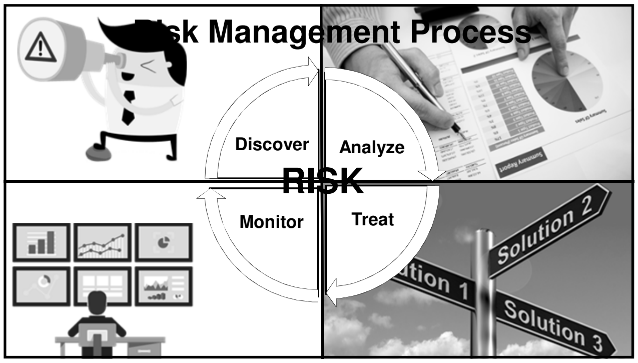
Part 2: Challenges/Pitfalls

Part 3: Quantitative Basics

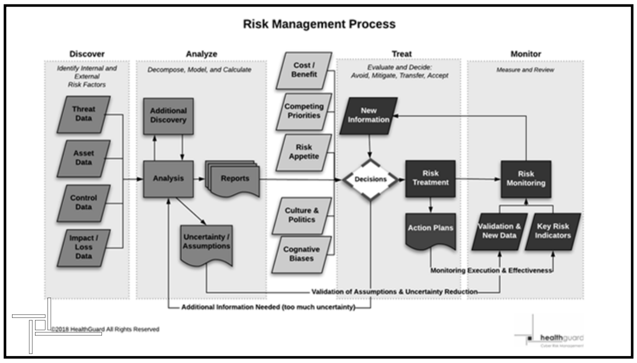
Common Analysis Methods

Why do we need to measure (aka analyze) risk?

Risk Management Process

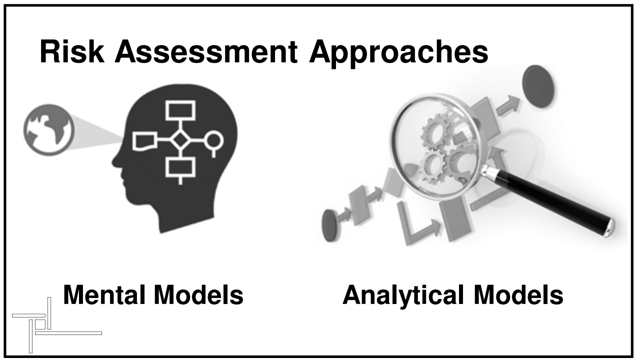


Risk Management Process



Informing Decisions / Answering Questions

- How do we prioritize our issues?
- How much should we invest, and where?
- What are we getting for our investment?



Risk Assessment Approaches

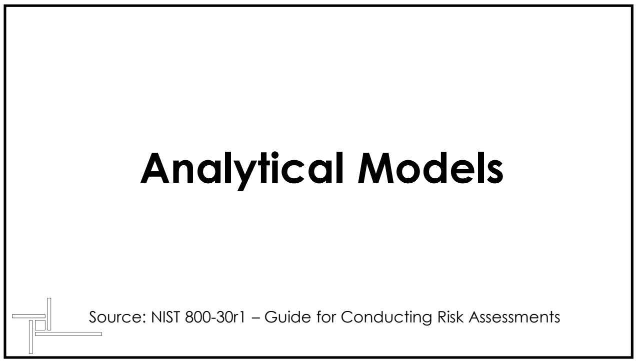
Mental Models

Analytical Models

Case Study:

TJX®

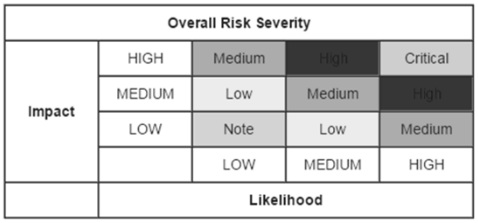
THE TJX COMPANIES, INC.



Analytical Models

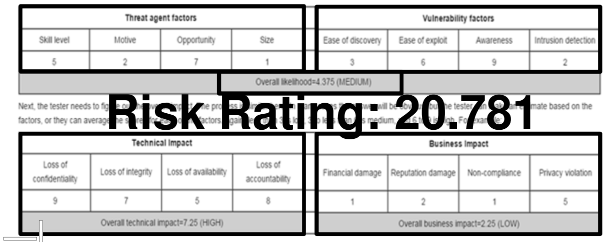
Source: NIST 800-30r1 – Guide for Conducting Risk Assessments

Qualitative Analysis



Overall Risk Severity				
Impact	HIGH	Medium	High	Critical
	MEDIUM	Low	Medium	High
	LOW	Note	Low	Medium
		LOW	MEDIUM	HIGH
	Likelihood			

Semi-Quantitative Analysis



Threat agent factors			
Skill level	Motive	Opportunity	Size
5	2	7	1

Vulnerability factors			
Ease of discovery	Ease of exploit	Awareness	Intrusion detection
3	6	9	2

Overall likelihood=4.375 (MEDIUM)

Risk Rating: 20.781

Next, the tester needs to fig[illegible] the [illegible] impact. The pro[illegible]ss is [illegible] th[illegible]swer will be obv[illegible] but the tester [illegible] an e[illegible]mate based on the factors, or they can average [illegible] factors. Agai[illegible] than 3 is lo[illegible] less than 6 is medium, [illegible] 6 to 9 is high. For exam[illegible]

Technical Impact			
Loss of confidentiality	Loss of integrity	Loss of availability	Loss of accountability
9	7	5	8
Overall technical impact=7.25 (HIGH)			

Business Impact			
Financial damage	Reputation damage	Non-compliance	Privacy violation
1	2	1	5
Overall business impact=2.25 (LOW)			

What if everything was measured like cyber risk?

How far to Wally World?

How far to Wally World?

Distance rating: 6

What is the size of the enemy force?

What is the size of the enemy force?

Medium

Organization	Security Risk Ratings Estimated Cost	Year
Epsilon	25 $4 Billion	2011
Veterans Administration	25 $500 Million	2006
Merck	25 $275 Million	2017
Hannaford Bros	25 $252 Million	2007
Sony PlayStation	25 $171 Million	2011
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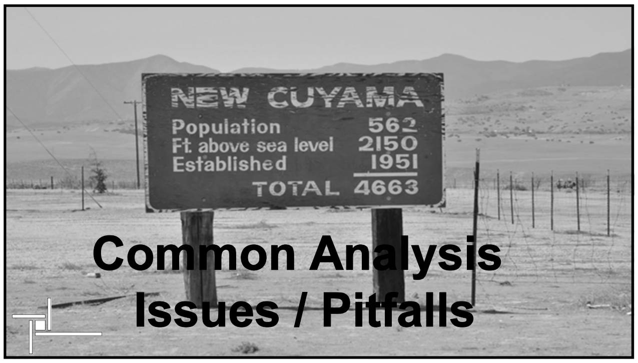
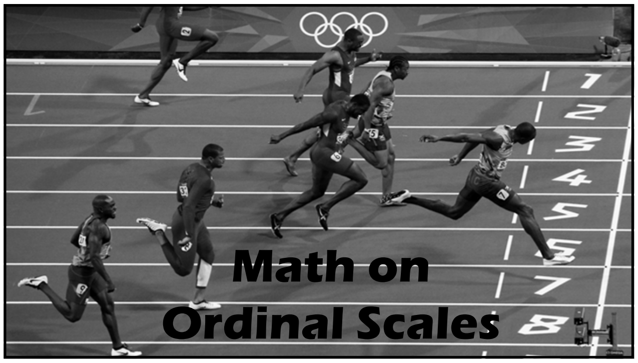
TJ Maxx	25 $162 Million	2007
Heartland Payment	24 $140 Million	2008
Anthem	23 $100 Million	2015
Sony Pictures Entertainment	23 $100 Million	2014
Home Depot	22 $56 Million	2014

Organization	Security Risk Levels Estimated Cost	Year
Epsilon	Very High $4 Billion	2011
Veterans Administration	Very High $500 Million	2006
Merck	Very High $275 Million	2017
Hannaford Bros	Very High $252 Million	2007
Sony PlayStation	High $171 Million	2011
Target	High $162 Million	2013
TJ Maxx	High $162 Million	2007
Heartland Payment	High $140 Million	2008
Anthem	High $100 Million	2015
Sony Pictures Entertainment	High $100 Million	2014
Home Depot	Medium High $56 Million	2014

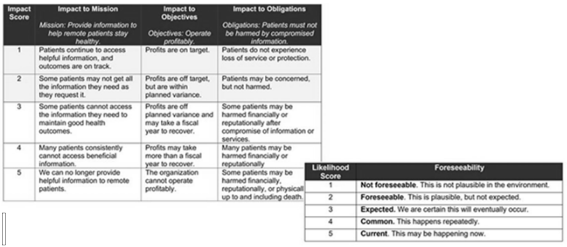


Common Analysis Issues / Pitfalls



Math on Ordinal Scales

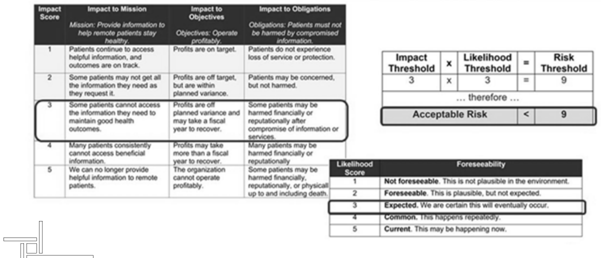
Semi-Quantitative Analysis



Impact Score	Impact to Mission *Mission: Provide information to help remote patients stay healthy.*	Impact to Objectives *Objectives: Operate profitably.*	Impact to Obligations *Obligations: Patients must not be harmed by compromised information.*
1	Patients continue to access helpful information, and outcomes are on track.	Profits are on target.	Patients do not experience loss of service or protection.
2	Some patients may not get all the information they need as they request it.	Profits are off target, but are within planned variance.	Patients may be concerned, but not harmed.
3	Some patients cannot access the information they need to maintain good health outcomes.	Profits are off planned variance and may take a fiscal year to recover.	Some patients may be harmed financially or reputationally after compromise of information or services.
4	Many patients consistently cannot access beneficial information.	Profits may take more than a fiscal year to recover.	Many patients may be harmed financially or reputationally
5	We can no longer provide helpful information to remote patients.	The organization cannot operate profitably.	Some patients may be harmed financially, reputationally, or physicall up to and including death.

Likelihood Score	Foreseeability
1	**Not foreseeable**. This is not plausible in the environment.
2	**Foreseeable**. This is plausible, but not expected.
3	**Expected.** We are certain this will eventually occur.
4	**Common.** This happens repeatedly.
5	**Current**. This may be happening now.

Semi-Quantitative Analysis



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5	We can no longer provide helpful information to remote patients.	The organization cannot operate profitably.	Some patients may be harmed financially, reputationally, or physicall up to and including death.

Impact Threshold	x	Likelihood Threshold	=	Risk Threshold
3	x	3	=	9
… therefore …				
Acceptable Risk			<	9

Likelihood Score	Foreseeability
1	**Not foreseeable**. This is not plausible in the environment.
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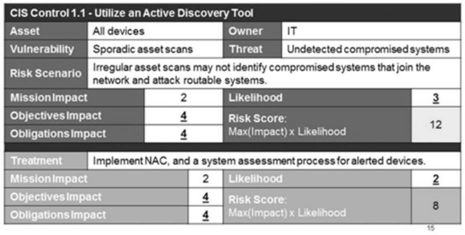
Semi-Quantitative Analysis



CIS Control 1.1 - Utilize an Active Discovery Tool			
Asset	All devices	Owner	IT
Vulnerability	Sporadic asset scans	Threat	Undetected compromised systems
Risk Scenario	Irregular asset scans may not identify compromised systems that join the network and attack routable systems.		
Mission Impact	2	Likelihood	3
Objectives Impact	4	Risk Score: Max(Impact) x Likelihood	12
Obligations Impact	4		
Treatment	Implement NAC, and a system assessment process for alerted devices.		
Mission Impact	2	Likelihood	2
Objectives Impact	4	Risk Score: Max(Impact) x Likelihood	8
Obligations Impact	4		

15

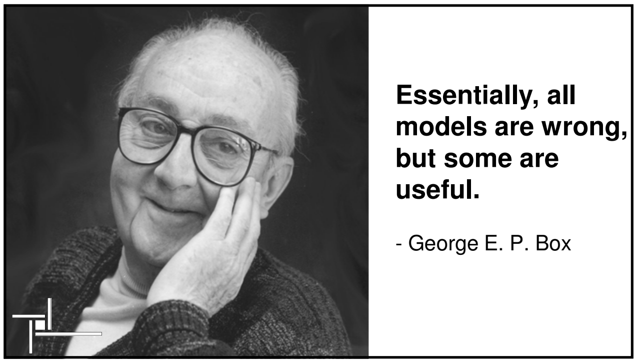
Measurement Scales

Scale	Order	Distance	True Zero	Examples
Nominal	No	No	No	Color, Gender, Ethnicity, Country
Ordinal	Yes	No	No	Rating Scales, Rank Order
Interval	Yes	Yes	No	Time of Day, IQ, Likert Scale, Temp.
Ratio	Yes	Yes	Yes	Age, Height, Cost, Weight

Measurement Scales

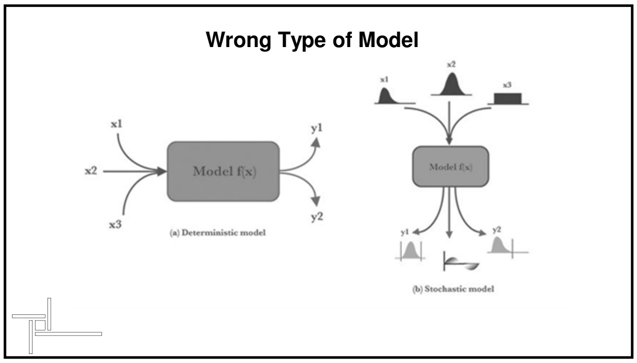
Scale	Permitted Mathematical Operations
Nominal	Counting
Ordinal	Greater than/less than
Interval	Addition, subtraction, multiplication, division; cannot make ratio statements
Ratio	Any, including ratios

BAD MODELS

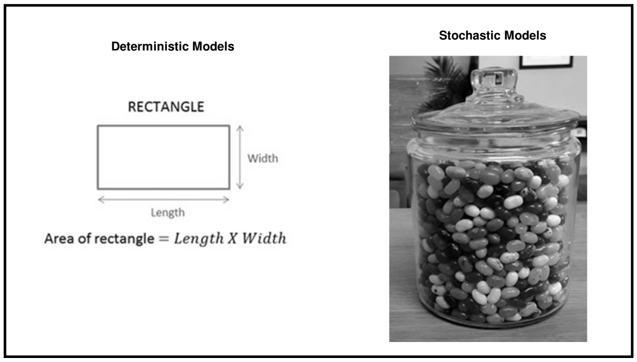


Essentially, all models are wrong, but some are useful.

- George E. P. Box



Wrong Type of Model

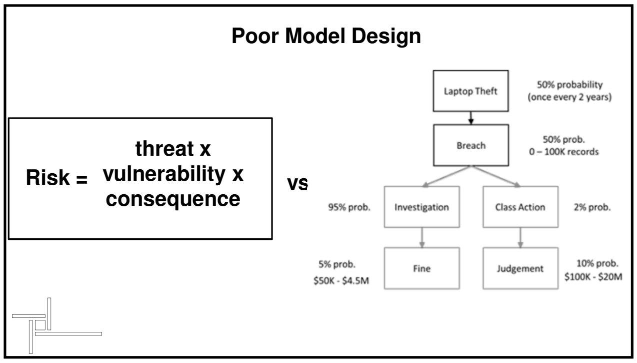


Deterministic Models

Stochastic Models

RECTANGLE

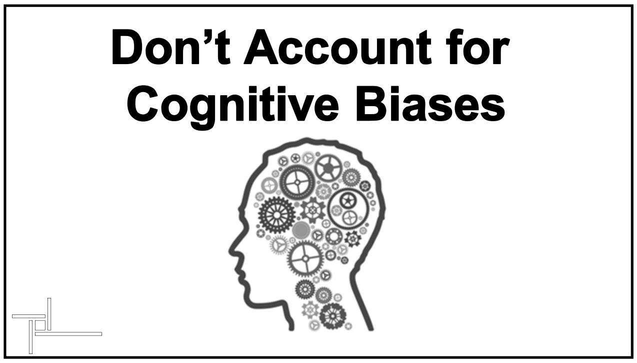
Area of rectangle = $Length\ X\ Width$



Poor Model Design

Risk = threat x vulnerability x consequence

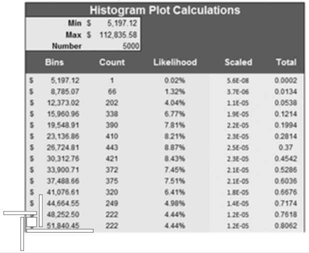
vs



Don’t Account for Cognitive Biases

Quantitative Analysis

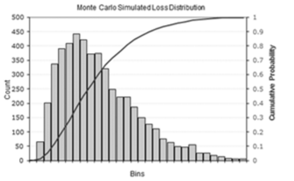
The histogram table below is used for calculating the likelihood of landing on a specific value during the simulation of loss over the 5000 sample trials.



Histogram Plot Calculations

Min	$	5,197.12
Max	$	112,835.58
Number		5000

Bins		Count	Likelihood	Scaled	Total
$	5,197.12	1	0.02%	5.6E-08	0.0002
$	8,785.07	66	1.32%	3.7E-06	0.0134
$	12,373.02	202	4.04%	1.1E-05	0.0538
$	15,960.96	338	6.77%	1.9E-05	0.1214
$	19,548.91	390	7.81%	2.2E-05	0.1994
$	23,136.86	410	8.21%	2.3E-05	0.2814
$	26,724.81	443	8.87%	2.5E-05	0.37
$	30,312.76	421	8.43%	2.3E-05	0.4542
$	33,900.71	372	7.45%	2.1E-05	0.5286
$	37,488.66	375	7.51%	2.1E-05	0.6036
$	41,076.61	320	6.41%	1.8E-05	0.6676
$	44,664.55	249	4.98%	1.4E-05	0.7174
$	48,252.50	222	4.44%	1.2E-05	0.7618
$	51,840.45	222	4.44%	1.2E-05	0.8062



This graph is built up from the histogram plot calculations table and shows the loss distribution function as a bar chart, as well as the cumulative probability distribution function.

Quantifying risk in three steps

Risk Analysis Basics

1. Develop The Risk Scenarios
2. Build the Model/Gather Data
3. Run The Simulation

Risk Scenario

Scenarios are a powerful tool in a risk manager's armory—they help professionals ask the right questions and prepare for the unexpected. **Scenario analysis has become a 'new' and best practice in enterprise risk management (ERM)**

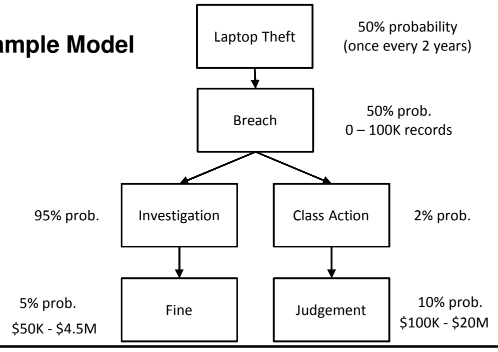
(Source: isaca.org)

Example Risk Scenario Statement

Risk scenario statement:

What is the risk associated with PHI being exposed via a lost/stolen laptop?

Example Model



Laptop Theft

50% probability
(once every 2 years)

Breach

50% prob.
0 – 100K records

95% prob.

Investigation

Class Action

2% prob.

5% prob.
$50K - $4.5M

Fine

Judgement

10% prob.
$100K - $20M

Simulations

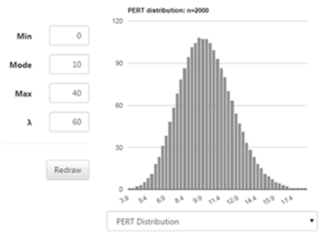
Two primary tools:

1. Probability Distributions (e.g. PERT)
2. Stochastic Modeling (e.g. Monte Carlo Simulation)

Pert Distibutions

Form of probability distribution used to model expert data.

Pert Distribution Histogram



Min 0

Mode 10

Max 40

λ 60

Monte Carlo Simulation

Computerized mathematical technique that allows people to account for risk in quantitative analysis and decision making.

Exercise:

Auditors report lack of laptop encryption is a "high risk" issue.

Encryption will require a $200-250K investment.

CFO wants to know if this is worth the investment.

Primary Loss Event Frequency

	Min (95% CI)	Most Likely	Max (95% CI)
LEF	0	1	5

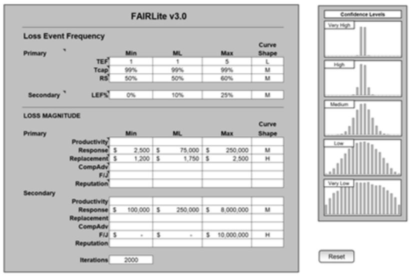
Primary Loss Magnitude

	Min (95% CI)	Most Likely	Max (95% CI)
Replacement Costs	$1,200	$1,750	$2,500
Response Costs	$2,500	$75K	$250K

Secondary Loss Magnitude

	Min (95% CI)	Most Likely	Max (95% CI)
Response Costs	$100K	$250K	$8M
Fines / Judgement	$0	$0	$10M

Monte Carlo Simulation



FAIRLite v3.0

Loss Event Frequency

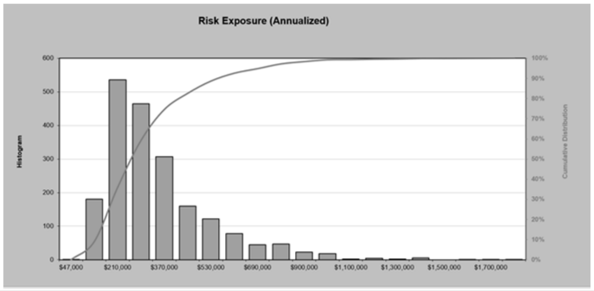
Primary		Min	ML	Max	Curve Shape
	TEF	1	1	5	L
	Tcap	99%	99%	99%	M
	RS	50%	50%	60%	M
Secondary	LEF%	0%	10%	25%	M

LOSS MAGNITUDE

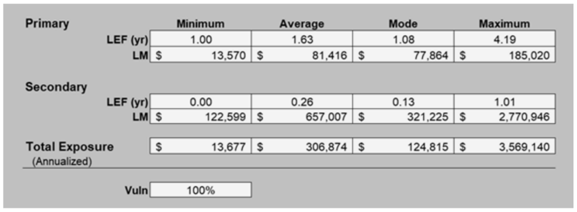
Primary		Min	ML	Max	Curve Shape
	Productivity				
	Response	$ 2,500	$ 75,000	$ 250,000	M
	Replacement	$ 1,200	$ 1,750	$ 2,500	H
	CompAdv				
	F/J				
	Reputation				
Secondary					
	Productivity				
	Response	$ 100,000	$ 250,000	$ 8,000,000	M
	Replacement				
	CompAdv				
	F/J	$ -	$ -	$ 10,000,000	H
	Reputation				

Iterations 2000

Simulation Output

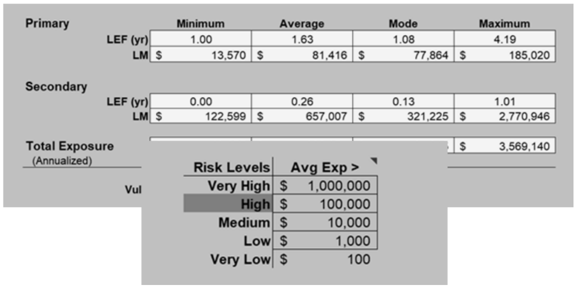


Simulation Output



Primary	Minimum	Average	Mode	Maximum
LEF (yr)	1.00	1.63	1.08	4.19
LM	$ 13,570	$ 81,416	$ 77,864	$ 185,020
Secondary				
LEF (yr)	0.00	0.26	0.13	1.01
LM	$ 122,599	$ 657,007	$ 321,225	$ 2,770,946
Total Exposure (Annualized)	$ 13,677	$ 306,874	$ 124,815	$ 3,569,140
Vuln	100%			

Simulation Output



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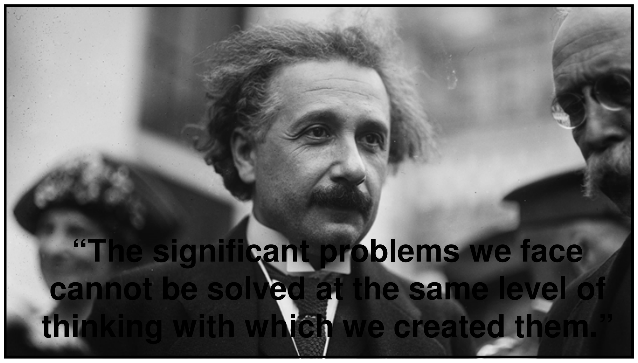
LEF (yr)	0.00	0.26	0.13	1.01
LM	$ 122,599	$ 657,007	$ 321,225	$ 2,770,946
Total Exposure (Annualized)				$ 3,569,140
Vul				

Risk Levels	Avg Exp >
Very High	$ 1,000,000
High	$ 100,000
Medium	$ 10,000
Low	$ 1,000
Very Low	$ 100



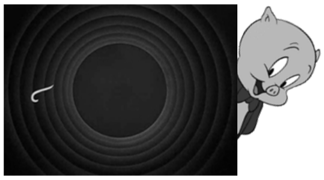
“The significant problems we face cannot be solved at the same level of thinking with which we created them.”

WHERE DO WE GO FROM HERE?

Public Beta Coming Soon

Introducing CyberEHR Analyze

www.healthguardsecurity.com/cyberehr-analyze/



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