To (Under/Over) Screen or Not to (Under/Over) Screen, That is the Question

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Executive Summary

Underscreening / Overscreening occur given the uncertainty associated with risk assessment and limited security resources available.

Right Screening is ideal, but challenging to attain for all passengers.

TSA Precheck implicitly focuses on underscreening, which is why it makes the air system safer, in low risk, cost-constrained environments.

November 2014 Presentation

Discussed the benefits of prescreening.

Discussed how economics can impact the screening resources allocation and utilization equation.

Introduced the concepts of underscreening and overscreening.

Screening Assessment

What is known: As risk increases, likelihood of a security threat outcome increases.

What is not known: **Exact** relationship between risk and security outcome.

Security Resources

What is known: Security resources are limited.

What is not known: **Exact** manner in how security resource limitations impact their allocation.

* Stochastic Knapsack Problem

Retrospective Security Resource Allocation

Know everyone's risk before they enter security screening; allocate security resources to match risk.

Final Assessments: Was there a successful attack?
Was the system being tested?

Assumptions:

Security resources are limited.

Screening procedures make errors

* False alarms, False clears.

Screening Procedure Reality

Screening decisions are made in **real-time.**

Each passenger has a risk profile

* Used to determine the security resources allocated to their screening.

Three possible scenarios:

Right Screening
Under Screening
Over Screening

Right Screening

Security resources allocated to a passenger ***match*** the retrospective security resource allocation.

Multilevel Passenger Screening Problem (MPSP): Maximizes the security of the system, subject to

1) security resource constraints / limitations,
2) performance limitations of these resources,
3) security devices / procedures may be assigned to multiple security classes.

Over / Under Screening

Security resources allocated to a passenger do not match the retrospective security resource allocation

Under ≡ too few resources are allocated

Over ≡ too many resources are allocated

Consequences

Underscreening

Security resources are under-utilized.

Will system be more vulnerable?

Overscreening

Security resources are over-utilized

Is system being too cautious?

Will system be more vulnerable?

By How Much?

One can count …

1) Number of passengers that are under/over screened,
2) How far are passengers under/over screened.
    - The number of security classes below /above the correct class a passenger should be assigned.

Question: Does it matter WHO is under/over screened?

Key Factors and Assumptions

There is inherent risk in the system.

* P{A passenger is carrying a threat with nefarious intent}.

System risk is low.

Security must estimate this level of risk.

* Tendency is to overestimate level of risk.

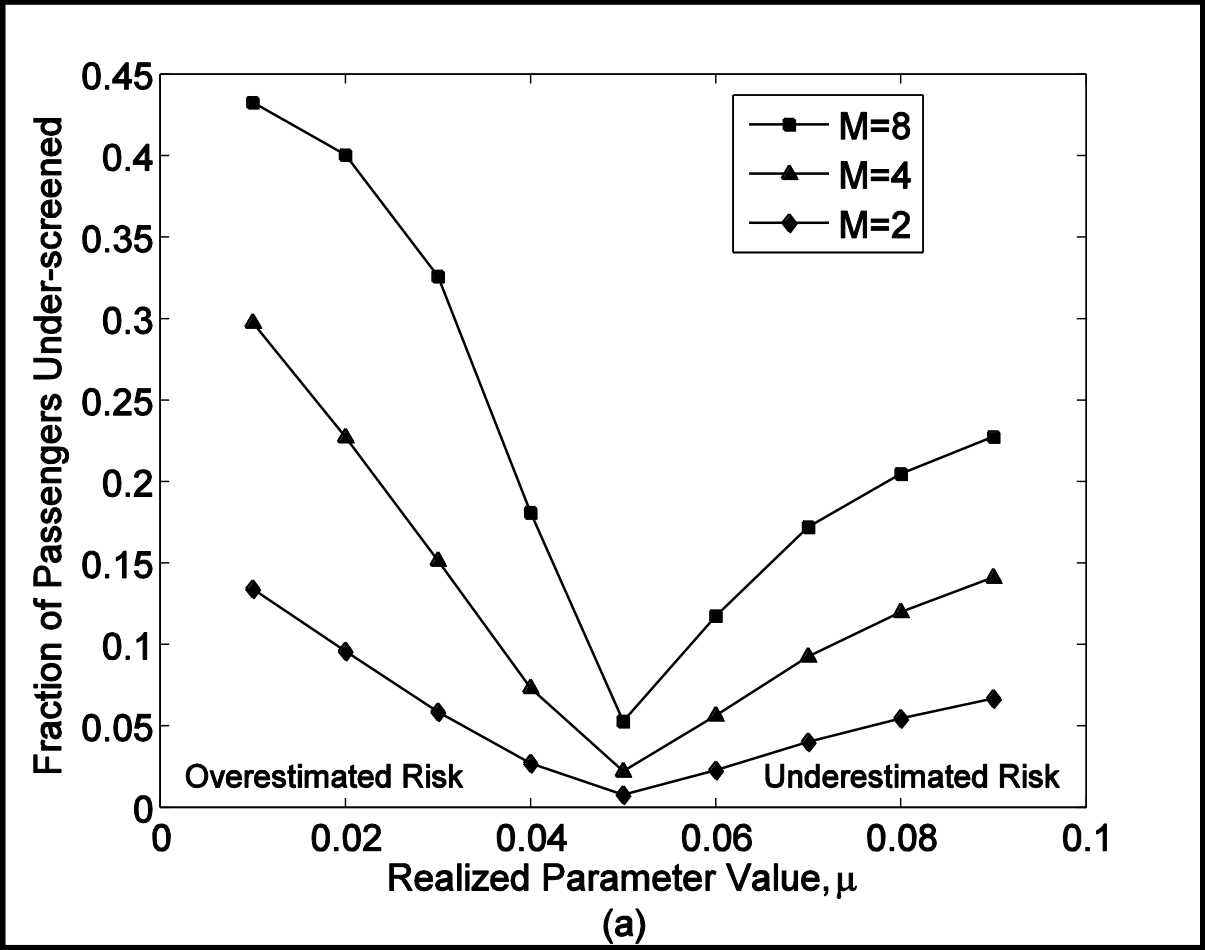
Overestimating Risk

True risk level (μ) < estimated risk level (μ').

System is safer (μ) than people believe it to be (μ').

Resources remain limited for each security class.

Underscreening Error



μ'=.05

M = Number of security classes

Discussion

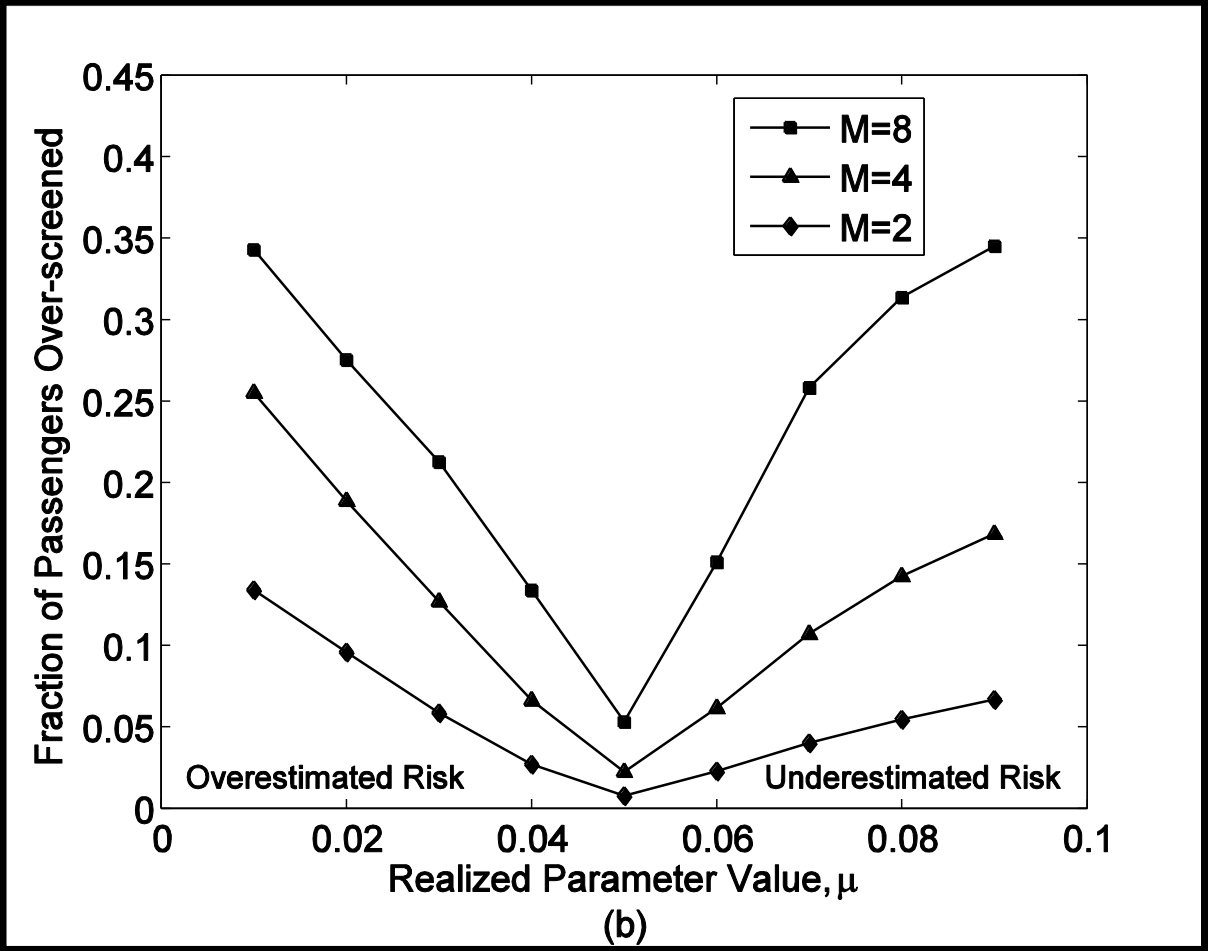
When risk is overestimated, high value security resources get used on low risk passengers, which may leave fewer high value security resources available for high risk passengers.

This leads to high risk passengers being underscreened, particularly as high value security resources get depleted.

Discussion

When risk is underestimated, high value security resources get used primarily on high risk passengers, which targets more closely the high value security resources for high risk passengers.

Overscreening Error



μ'=.05

M = Number of security classes

Discussion

When risk is overestimated, high value security resources get used on low risk passengers, which may leave fewer high value security resources available for high risk passengers.

This also leads to low and medium risk passengers being overscreened.

Discussion

When risk is underestimated, high value security resources get used primarily on high risk passengers, which targets more closely the high value security resources for high risk passengers.

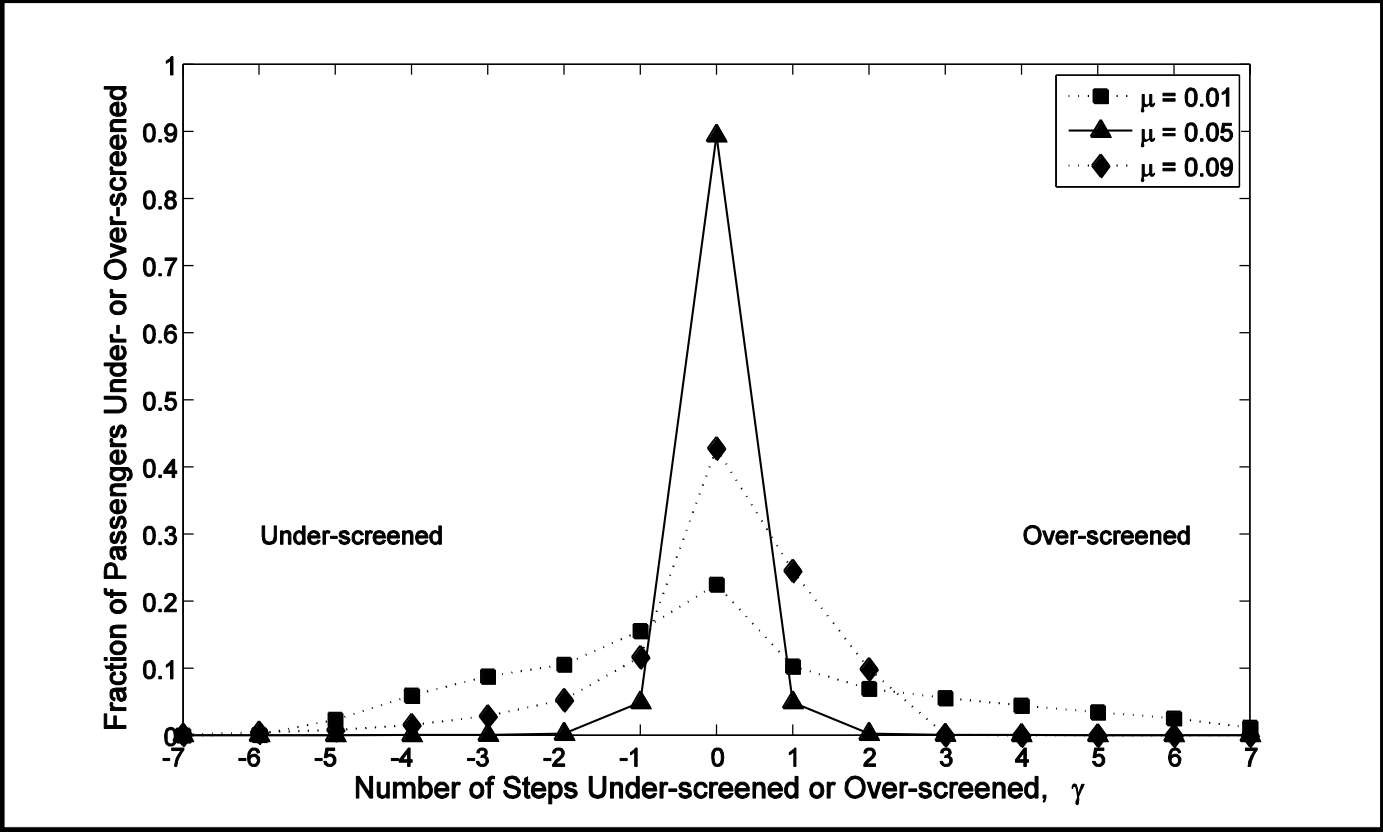
Key Observations

In low risk environments, overestimating risk leads to a greater mismatch between security resources and passenger risk.

In low risk environments, underestimating risk leads to lower levels of underscreening and (mostly, for M small) lower levels of overscreening, compared to overestimating risk.

By How Much?

When passengers are under/over screened, can we quantify by how much?



μ'=.05
M=8

What about in High Risk Environments?

Resources are typically too constrained to be effective.

Most passengers are underscreened.

Systems may need to be shut down (9/11).

Consequences

By underestimating system risk, fewer passengers are incorrectly screened than when system risk is overestimated

TSA Precheck exhibits this effect.

TSA Precheck makes the air system safer.

* Resource matching

Gaming Strategies

Blocking
Overtaxing
Timing
Trial and Testing

All can disrupt the system in limited resource environments

References

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Thank you

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