

Responsible Engineering in Healthcare



GCORP | **HS** Health Solutions

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First, do no harm.

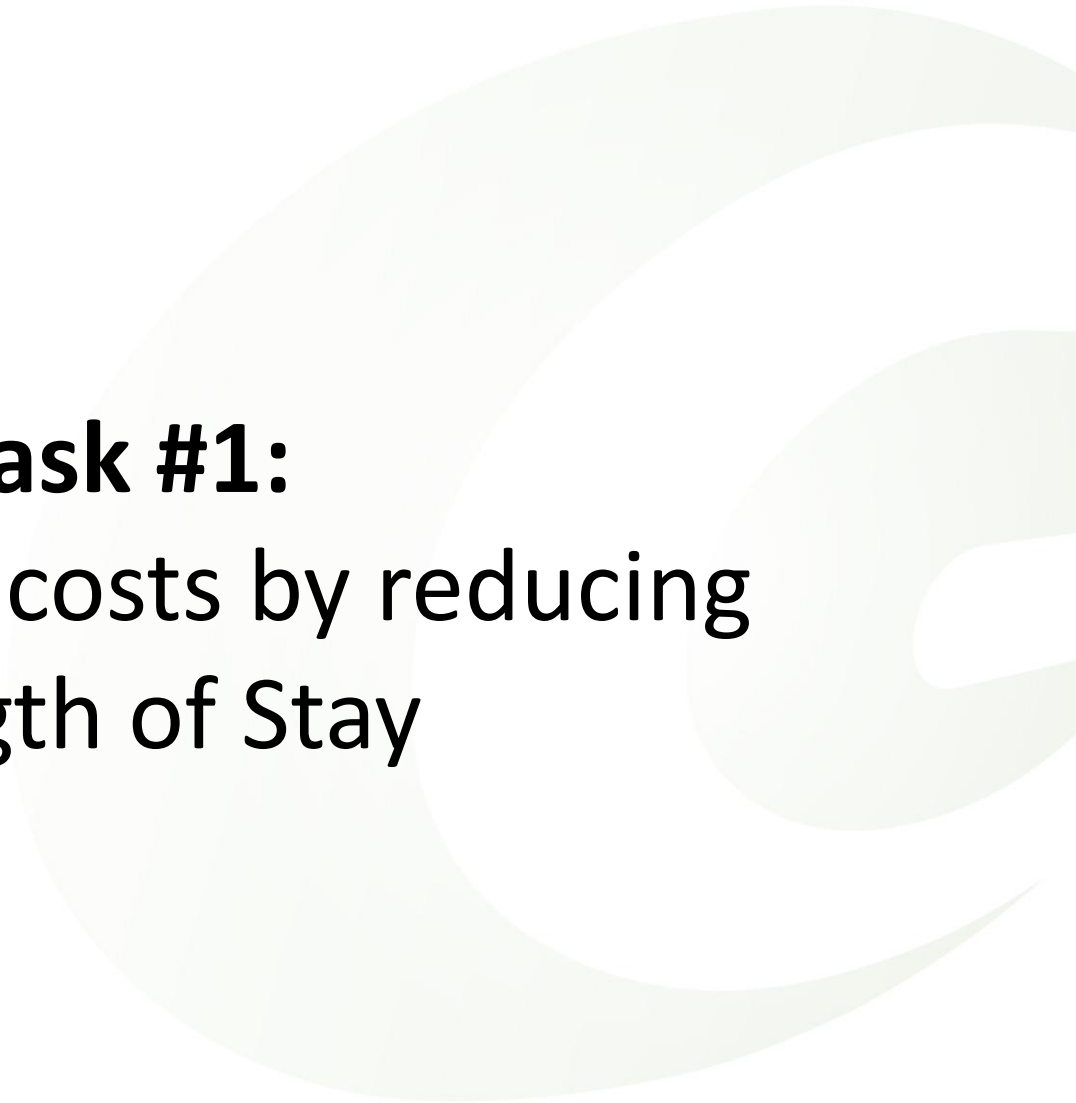

*Healthcare has a need for Systems Engineering;
however, solutions based upon common but
faulty assumptions will cause harm.*

WARNING!

**NEW HEALTHCARE
PARADIGMS MAY
LEAVE YOU DAZED
AND CONFUSED**

Theoretical Tasks

1. Minimizing costs by reducing Length of Stay
2. Reducing 30-day readmissions with technology
3. Increasing patient satisfaction by reducing wait times



Task #1:
Minimizing costs by reducing
Length of Stay

Background

- Average Length of Stay (LOS) for certain procedures varies among hospitals in same system.
- 1,600 bed-days and associated costs could be avoided if all hospitals achieved the minimum LOS.
- Bonus: Those beds would be available for other procedures.

“Solution”

Implement strict rules on LOS for certain heart conditions and require justification for anything over the minimum LOS.

Results...as expected

After 6 weeks, average LOS dropped by 15%.

Surprise!

After 12 weeks, extra capacity filled with
new (unique) heart patients.



Why?

Supply sensitive care.



The Three Types of Care

- **Necessary and Effective** (~12%)
 - “One right answer”
 - Example: Beta-blockers for heart attacks victims
- **Preference Sensitive** (~25%)
 - Multiple viable options
 - Example: Choice between mastectomy and lumpectomy
- **Supply Sensitive** (~63%)
 - Influenced by regional supply
 - Example: Invasive interventions for cardiac disease
 - Note: *More care is not correlated with better outcomes!*
- Additional Reading: *Tracking Medicine* by Jack Wennberg



Spillover: Patients released too soon are returning with complications.

Task #2: Reducing 30-day readmissions with technology

Background

Finance team notices high cost of 30-day readmissions for patients returning with heart conditions.

“Solution”

Technology director has a plan!

Provide patients with a take-home sensor kit.

Results...as expected

- Nearly 20% of patients asked to return for screening after “anomalies” are found.
- Some of these patients were in need of treatment.

Surprise!

- Screening team is overloaded.
- Patient wait times increase dramatically.

Why?

- Tech team did not coordinate with the lab.
- In-home monitors identify numerous “anomalies.”

The Problem of Inference

- No statistical analysis on “new” home data
- Reliance on humans for inference (turning data into knowledge) is error-prone
- Accuracy of inferences is hard to judge
- Resulting actions may be ineffectual or *harmful*
- Additional Reading: *Frontiers in Massive Data Analysis* from the National Research Council



Spillover: Patient satisfaction is decreasing due to increased screening.

Task #3:

Increasing patient satisfaction by reducing wait times

Background

- Patient satisfaction scores recently dropped.
- Lab director “knows” the problem is due to the long lines.

“Solution”

Lean team helps re-map the screening process.

Results...as expected

- Wait times are nearly eliminated.
- Throughput increases 30%.



Surprise!

Patient satisfaction scores fall even lower.



Why?

There are 6 possible outcomes to any screening, but *only 1 outcome benefits the health of the patient.*

The 6 Possible Outcomes of any Screening (part 1)

- ✘ **True negative**. Patient is subject to costs, risks, and anxiety of testing but receives no health benefit.
- ✘ **False negative**. Patient is wrongly reassured.
- ✘ **False Positive**. Patient is subject to risks, costs, and anxiety of further testing.

The 6 Possible Outcomes of any Screening (part 2)

- ✘ **True Positive** *but patient is not destined to be affected by the disease.* Patient is subject to risks, costs, and anxiety of further treatment.
- ✘ **True positive** *but early detection will not affect the outcomes of treatment.* Patient is subject to risks, costs, and anxiety of further treatment.

The 6 Possible Outcomes of any Screening (part 3)



- True positive** *and early treatment prevents complications.* Patient receives timely care.
- Additional Reading: *Overdiagnosed* by Gil Welch

In the end...

- Cost saving initiative drove up costs
 - More readmissions (induced by inappropriate LOS)
 - More screenings (from 30-day readmission “fix”)
- Cost saving initiative reduced reimbursement
 - Reimbursements are tied to patient satisfaction scores which decreased (due to “overdiagnosis”)

How a Systems Engineer could have stopped the cascade of bad events

- Task 1 – Requirements elicitation would focus solutions on affecting total patient costs.
- Task 2 – Root-cause analysis would have identified new LOS rules as the problem.
- Task 3 – Root-cause analysis would have identified true patient concerns.
- Spillovers – Risk analysis/management would have identified/mitigated second order affects.



Time for Q & A

Wrap up: Responsible Engineering

- Be sure to understand the overarching goal – *Proper requirements elicitation!*
- Take time to identify root cause before forming solutions
- Perform thorough risk analysis
 - Anticipate potential second and third order effects
 - Know the peculiarities of healthcare
- And remember: ***First, do no harm!***

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Thank you!



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