Inpatient Flow Optimization

COMPLETE ML SOLUTION PROVIDING KEY PREDICTIONS ON HOSPITAL ADMISSIONS, ED FLOW, AND DISCHARGE

Inpatient care is the most expensive aspect of the US health system, accounting for over $377B in annual healthcare costs and 1/3 of healthcare expenditures. Inpatient admission will occur for a variety of reasons, from an elective surgical procedure to urgent or emergent care needs. Inefficiencies in moving patients within the system are responsible for unnecessary transfers, longer waits, additional adverse events, and wasteful expense. Using an end-to-end suite of machine learning insights, KenSci can optimize the movement of patients through the health system achieving better outcomes at a lower cost.

A substantial fraction of inpatient-related expenditures in the US are preventable; several studies have examined excessive hospital length of stay, finding that between 20% and 50%[8] may be excessive length of stay. This corresponds to over $100B in potential savings if reductions in length of stay could be realized (for a typical hospital this would be on the order of $10s of millions of dollars in savings annually).

Hospital readmissions are enormously costly to healthcare payers. Fines instituted by payers like Medicare now result in hospital losses of over $550M per year in HRRP penalties. Currently, 80% of hospitals are penalized for HRRP readmissions (up to 3% of Medicare reimbursement). A recent JAMA Internal Medicine study[9] from UCSF identified 26.9% of hospital readmissions are preventable. Furthermore, length of stay and readmissions represent counterbalanced metrics - optimizing for one without considering the other could be futile or even counter productive[10] - thus, risk of 30-day readmission and inpatient length of stay must be considered together. Correct allocation of patients within the hospital setting is also important to optimize patient flow and minimize inefficiencies.

In 2012, there were 36.5M inpatient hospital stays in the United States, with an average length of stay of 4.5 days.[1]

Preventing a single readmission has been projected to save $8,000-$10,000.

The Value of ML in Inpatient Flow

KenSci has identified multiple opportunity areas for implementing a prediction platform. The accurate estimation of length of stay and the implementation of strategies to act on these predictions affects planning future bed usage, identifying specialists for patients with multiple diagnoses, determining health insurance schemes and reimbursement systems in the private sector, planning discharge dates, and allowing families to better plan for the return of their relatives.[4] Hospital length of stay is often used as an indicator of efficiency of care and organizational performance.[5] Ineffective prediction of length of stay negatively affects cost, outcomes, and quality of care.

> “Patients put in Observation are considered to be outpatients and Medicare requires them to pay some of the cost for each hospital service delivered with no limit on the total they may owe.”[7]

Overall, inefficiencies in this system create bottlenecks that reduce throughput, affect the quality of patient care, and affect upstream components such as ED patient boarding. The variation in inpatient flow is not directly due to patient clinical

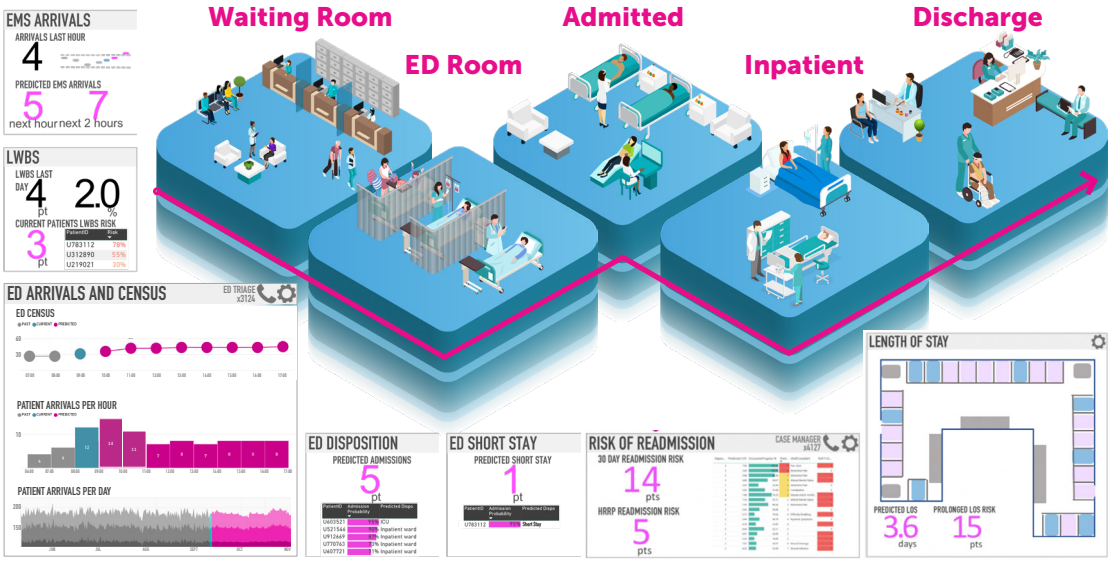

Figure 1
Inpatient Flow Diagram

complexity; hospital processes, particularly around elective surgical scheduling, discharge planning, and demand for restricted hospital resources like ICU care have a great impact on inpatient flow variation.[3]

Our Approach & Identified Opportunities

For many hospitals and health systems, unwarranted variation in care can lead to suboptimal patient outcomes and increased costs that are not necessary. This variation exists when there is a gap between what would be the desired best practice and what the is actual current practice.[6]

KenSci offers predictive insights within this "complex adaptive system" for inpatient flow, including:

- Predicting Inpatient length of stay
- Predicting risk of 30-day readmission
- Predicting Discharge Optimization

Variation is inherent in healthcare. Leveraging publicly available data and data from across your hospital system, the KenSci inpatient flow solution can identify significant variation across measures like average length of stay and performance metrics including 30-day readmission rates. Such variation provides an opportunity to examine more granular data and identify pivots to aid predictions. For example, there may be length of stay patterns specific to one inpatient ward, while another facility may experience more ICU transfers. Realizing and describing this variation will allow KenSci machine learning models to more accurately understand the underlying factors leading to the variation within your system, therefore laying the foundation for process improvement strategies that are shared between your services or institutions. With the help of the accurate estimation of the LOS of patients and associated insights, your hospitals can plan for more efficient resource utilization across your entire system.

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KenSci

KenSci's risk prediction platform identifies population health risks, optimizes clinical outcomes and operationalizes efficiency across the care continuum, making healthcare more proactive, coordinated and accountable - fast.

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