CASE STUDY

Reducing Unnecessary ED Utilization with *Artificial Intelligence and Machine Learning*

Southwestern Health Resources

Texas Health Resources®   UT Southwestern Medical Center®

Building a better way to care, *together*

Southwestern Health Resources (SWHR) is a patient-centered, clinically integrated network of **31 hospital locations** and more than **7,000 physicians** and **clinicians** caring for more than **790,000 patients** across **16 counties** in North Texas. Blending the strengths of **Texas Health Resources** and the **University of Texas Southwestern Medical Center,** SWHR offers an unmatched ability to connect individuals with a full spectrum of nationally preeminent, clinical care.

In addition, SWHR is the parent of **Care N' Care Insurance Company Inc.,** a regional Medicare Advantage health plan that serves North Texas residents 65 and older.

At SWHR, we believe healthcare can be more **integrated**, **accessible** and **affordable** for all.

OUR PURPOSE: To build a better way to care, together.

OUR PROMISE: To simplify and empower care, for good.

Executive Summary

Executive Summary

It has been estimated that up to ONE THIRD of all emergency department (ED) visits are not emergencies.

This misuse of emergency services can be due to **numerous factors**, including social determinant of health issues such as lack of insurance or low socioeconomic status, as well as common misunderstandings regarding the urgency of a particular health concern.[1]

For some, the emergency department (ED) is **perceived as a first-choice solution** for healthcare instead of the primary care physician or an urgent care center that would be more suitable for treatment needs.

ED care is significantly more expensive than other channels of care and its misuse has a cumulative impact on the healthcare industry. A recent study showed that $8.3 billion is spent each year on ED treatments that would have been more affordable if provided through another location.[2]

Because interventions are resource intensive, SWHR worked with ClosedLoop to **create an artificial intelligence/machine learning (AI/ML) model** to identify individuals at high risk for costly, preventable events, and intervene to keep them out of the emergency room.

>2% reduction in avoidable emergency department utilization vs. 2021 utilization

30× enrichment in high utilizers correctly predicted by the AI/ML in the top 1% by risk vs. the general population

22% of all high utilizers correctly identified in the top 1% of the Medicare Advantage population sorted by predicted risk

$2.5M retained from budget for SWHR Medicare Advantage population in 2022

The SWHR AI/ML model reduced ED utilization by more than forecast and resulted in $2.5 million retained instead of spent on unnecessary care in the first half of 2022.

1   Doobinin KA, Heidt-Davis PE, Gross TK, Isaacman DJ. Non-urgent pediatric emergency department visits: Care-seeking behavior and parental knowledge of insurance. Pediatr Emerg Care. 2003;19:10–14

2   Weinick RM, Burns RM, Mehrotra A. Many emergency department visits could be managed at urgent care centers and retail clinics. Health Affairs. 2010;29(9):1630-1636.

The Problem

The Problem

Preventable healthcare costs due to ED misuse occur for a variety of reasons. One contributing factor may be because patients don't have timely access to primary care physicians or aren't aware of urgent care options and available hours of operation. In addition, most emergency departments don't turn away patients, leading those with barriers to care associated with social determinants of health (SDoH) to overuse this option.

The negative impact of ED overuse is significant. Healthcare costs soar while the quality of ED care decreases. Crowded reception areas and long waits in emergency rooms interfere with the needs of those who truly need emergency attention. At the same time, the emergency department cannot provide the consistency of care a primary care provider can offer, resulting in overall diminishment of health outcomes for frequent ED users.

To reduce unnecessary ED use, SWHR created a customized AI/ML model that could predict individuals most likely to have multiple ED visits in the near future and bring to the surface their actionable SDoH-related risk factors so they could be addressed.
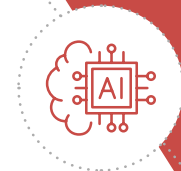
The Solution

The Solution

SWHR chose the ClosedLoop artificial intelligence, machine learning (AI/ML) platform because of its robust healthcare-specific content and the ability of the platform to incorporate social determinants of health.

SWHR built and deployed an AI/ML model to predict ED high utilizers (EDHUs). The model predicts an individual's risk of experiencing three or more ED visits in the next six months and explains each individual's unique risk factors.

With these risk factors top of mind, medical providers in the community can be proactive and encourage high utilizers to seek care through more appropriate channels.

With a goal of delivering the right care at the right time in the right place, ED diversions included reductions in visits due to urinary tract infection or general respiratory care, headaches and abdominal pain, among other ailments. Redirecting patients to their primary care physician or urgent care center created a more positive experience for the patient while reducing total healthcare costs.

Building an AI/ML Model

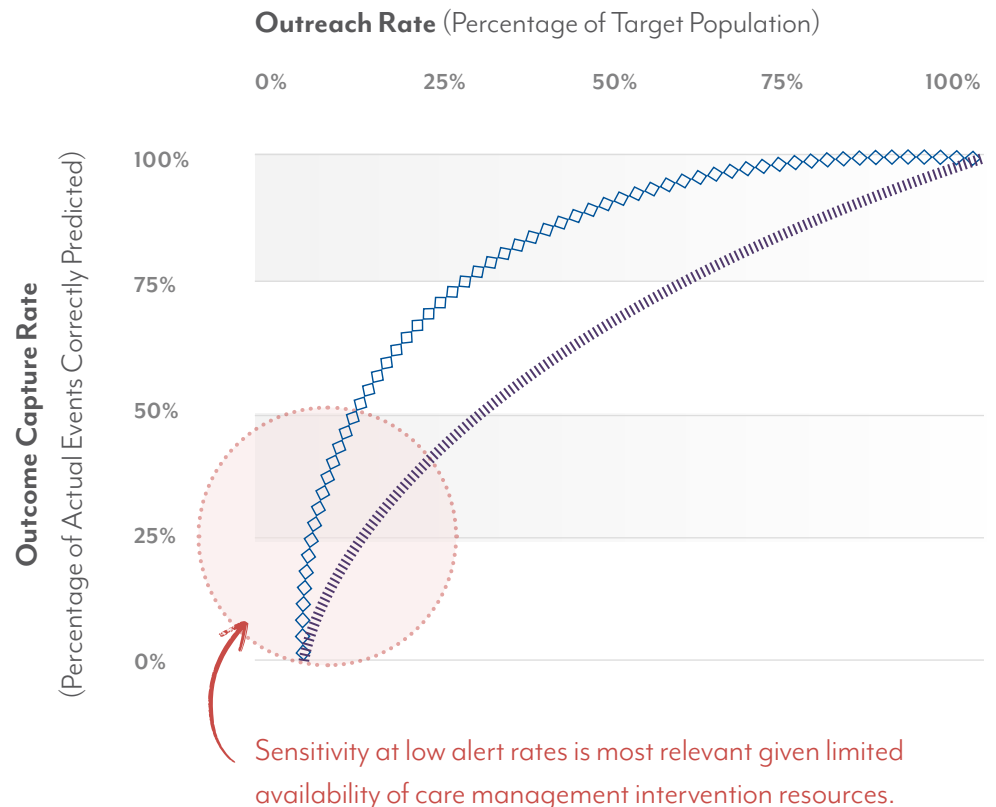# Building an AI/ML Model: The Opportunity

MODEL PERFORMANCE:

Area Under ROC = 0.86

◇◇◇◇ **The blue curve** demonstrates the measurable impact AI/ML achieved in identifying high-risk patients among the SWHR population who could then be contacted to optimize care.

〰〰〰 **Outcome capture curve:**

+ More relevant to intervention programs

+ Equivalent to Sensitivity (Y) vs. Alert Rate (X)

+ If reaching out to top X% by predicted risk, expect to capture Y% of actual outcomes

Following the law of diminishing returns — and to achieve our goals as a value-based care network — SWHR seeks to achieve the greatest gains with limited resources. Predictive modeling "takes out the noise" and stratifies patients by risk status, identifying a desirable pool of patients for an intervention. Based on the curve, SWHR only has to target the top 5% of rising-risk patients to impact 50% of actual population health outcomes.

Outreach Rate (Percentage of Target Population)

| 0% | 25% | 50% | 75% | 100% |

Outcome Capture Rate
(Percentage of Actual Events Correctly Predicted)

100%

75%

50%

25%

0%

Sensitivity at low alert rates is most relevant given limited availability of care management intervention resources.

⊕ Patients and Risk

Patients and Risk

A KEY TO SUCCESS in population health management is understanding the risk associated with the population of interest and then targeting interventions based on the appropriate area of risk.

On the previous slide, the chart documented how, *using an AI model*, SWHR was able to target the top 5–10% of at-risk patients to impact 50% of the patient population, compared to the traditional model shown below where we'd previously only been able to target the top 1% of catastrophic illness patients and influence fewer than 10% of outcomes.

MARGIN:

+ No management: **9.7%**

+ High risk only: **-4.9%**

+ High risk and rising risk: **3%**

+ All levels: **9%**

1% Catastrohic illness

4% +5 Chronic conditions

HIGH-COST PATIENTS

RISING-RISK PATIENTS

20% 2–4 Chronic conditions

AT-RISK PATIENTS

25% 1 Chronic condition

15% At risk for developing chronic condition

HEALTHY PATIENTS

35% No ongoing physical health needs

Clinical Risk   Social Risk   Behavioral Risk
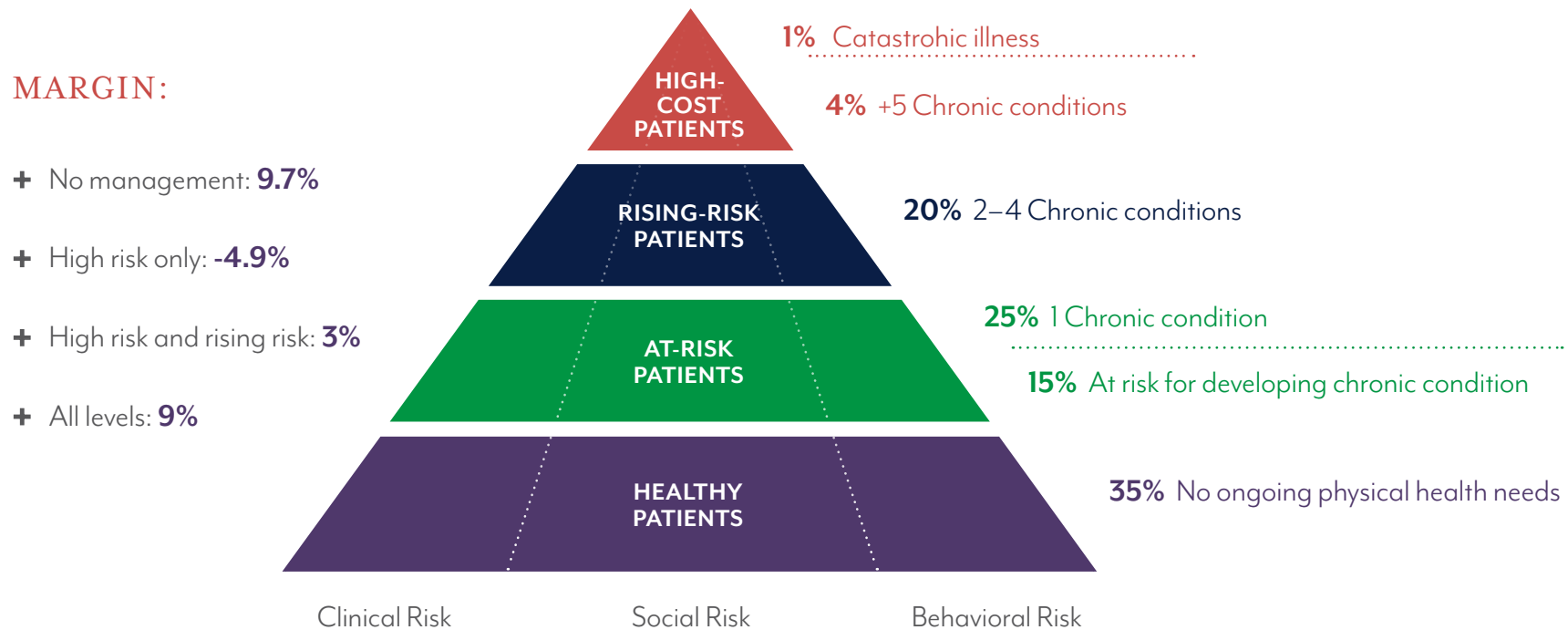
⊙ Population-Level Top Contributing Factors

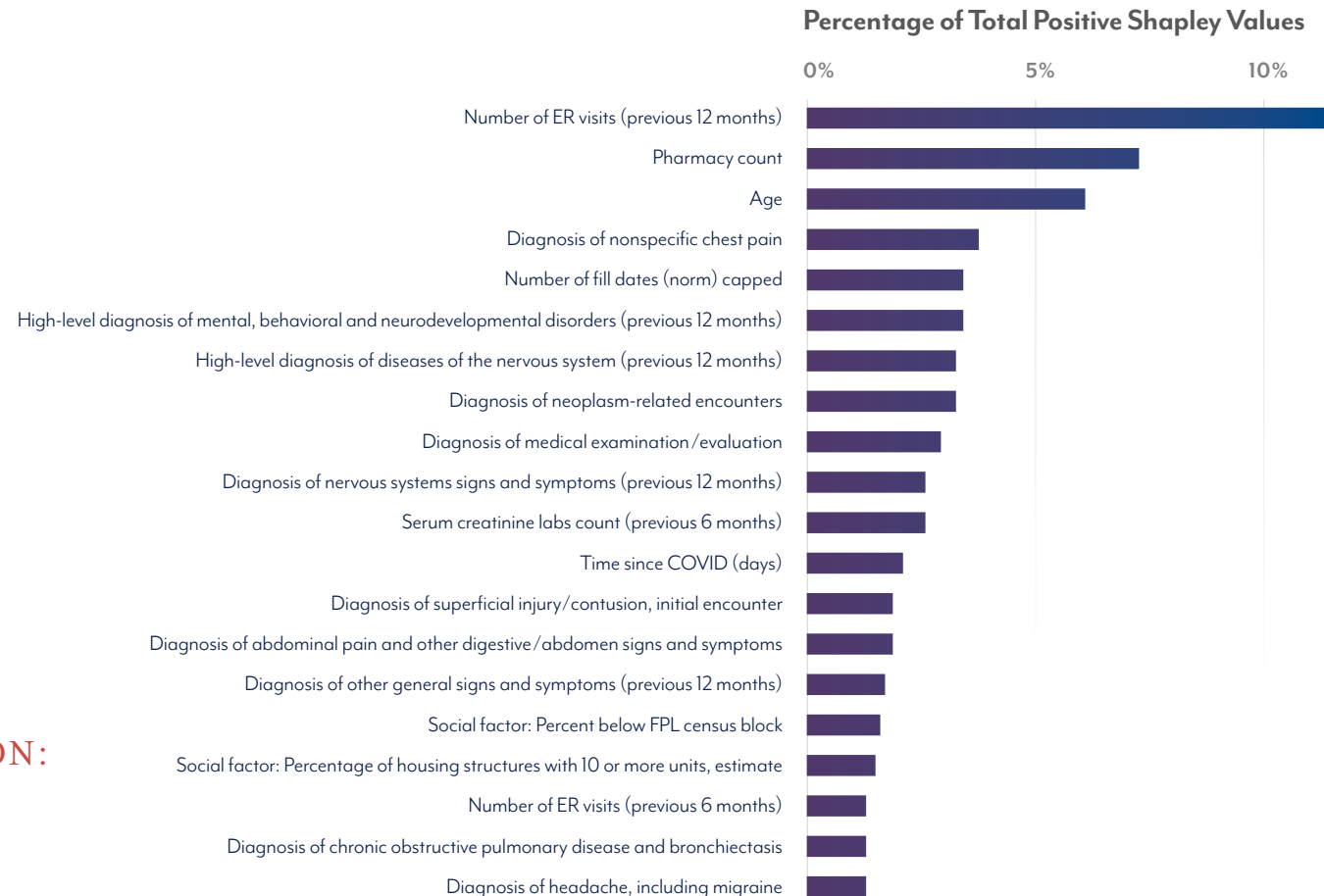# Population-Level Top Contributing Factors

DIAGNOSIS HISTORY:

+ Chest pain

+ Mental, behavioral, neuro-developmental disorders

+ Diseases of the nervous system

+ Neoplasm-related disorders

MEDICATIONS:

+ The number of pharmacies at which member has filled a prescription in last 12 months

+ The number of fill dates per month

SDOH AND UTILIZATION:

+ ER visits in last 12 months

+ Serum creatinine lab count in last 6 months

Percentage of Total Positive Shapley Values

Factor	
Number of ER visits (previous 12 months)	
Pharmacy count	
Age	
Diagnosis of nonspecific chest pain	
Number of fill dates (norm) capped	
High-level diagnosis of mental, behavioral and neurodevelopmental disorders (previous 12 months)	
High-level diagnosis of diseases of the nervous system (previous 12 months)	
Diagnosis of neoplasm-related encounters	
Diagnosis of medical examination/evaluation	
Diagnosis of nervous systems signs and symptoms (previous 12 months)	
Serum creatinine labs count (previous 6 months)	
Time since COVID (days)	
Diagnosis of superficial injury/contusion, initial encounter	
Diagnosis of abdominal pain and other digestive/abdomen signs and symptoms	
Diagnosis of other general signs and symptoms (previous 12 months)	
Social factor: Percent below FPL census block	
Social factor: Percentage of housing structures with 10 or more units, estimate	
Number of ER visits (previous 6 months)	
Diagnosis of chronic obstructive pulmonary disease and bronchiectasis	
Diagnosis of headache, including migraine	

(→) Informing Interventions

Informing Interventions

When it comes to healthcare, consumers have choices. Whether it's a minor mishap or a major injury, understanding the suitability of a visit to the hospital emergency room versus an urgent care center versus a visit to an individual's primary care physician can impact each person's care experience (while saving time and money when done correctly). Ensuring the "right care at the right time in the right place" begins with education. An ED Diversion utilization kit was developed and shared with independent providers within the SWHR clinically integrated network, in addition to consumer tools like a patient education flyer and video. The goal is to help all audiences understand and pursue appropriate channels of care based on emergency or non-emergent needs.

ED DIVERSION UTILIZATION KIT:

+ Lists of patients at risk of high utilization

+ Lists of patients with past high utilization (within 6 months) ranked with current risk of future/continued high utilization

+ Lists of patients not being seen ranked by risk of high utilization

+ Illustrations of how reduction of risk of high utilization relates to reduction of Total Cost of Care (TCOC) over time

+ Targeted education to those patients identified as being at risk for high utilization

+ Wraparound services (nursing, social workers, and pharmacists) deployed to patients at risk for high utilization with key assessments to identify interventions needed to reduce their risk

PATIENT EDUCATION FLYER:

+ This downloadable flyer outlines alternative solutions to the ED and where to go for the care you need. Sharing this "where to go when" flyer with providers and their patients helps ensure appropriate utilization of SWHR clinically integrated channels of care. Click here to download the flyer

+ Click here to visit the webpage: "Where To Go For Care"

+ Click here to watch a video identifying where to go when you need healthcare

→ The Results

The Results

The AI/ML model was able to **identify 21.8% of all Emergency Department High Utilizers (EDHU)** in the **riskiest 1% of SWHR's Medicare Advantage population** as sorted by the model. While this represents a 30-fold improvement over randomly targeting 1% of the population, continual refinement of the model will provide an opportunity for even greater impact.

Within the first six months, using this model with SWHR Medicare Advantage plan patients reduced avoidable ED utilization by more than the expected 2%, **resulting in $2.5 million in savings** that could be reallocated for appropriate care.

As shown on the chart below, when evaluating metrics of success, it is useful to look at utilization per member per month (PMPM), as well as traffic to the Emergency Department as "visits per thousand." Between 2021 and the launch of ED Diversion efforts in 2022, Southwestern Health Resources saw a decline of 5.20% in costs per member per month, due to improved utilization. Utilization of the emergency department in 2021 averaged 48.4 visits per thousand. After interventions and education launched in 2022, that number declined to 44.7 visits per thousand, an improvement of 5.40%, demonstrating that SWHR is making progress to ensure the right care at the right time and in the right channel of care. It is reasonable to believe these percentages will continue to improve as SWHR providers and patients grow in their understanding and appropriate utilization of the primary care provider and urgent care centers for non-emergent needs.

REDUCTION OF UTILIZATION AVOIDABLE ED VISITS:

Per Member Per Month (PMPM) + Visits per 1,000

Metrics of Success	2021	2022	% Decline	Variance
Avoidable PMPM	$1.82	$1.78	5.20%	-8%
Avoidable Utilization per 1,000	48.4	44.7	5.40%	-2%