Merit Medicine

White Paper: Using AI-Led Predictive Analytics to Improve Underwriting Outcomes

A Retrospective Case Study on Improving Risk Selection, Pricing Discipline, and Capital Efficiency Across Risk-Bearing Health Insurance Portfolios

Applicable to stop-loss carriers, MGUs, primary carriers, and reinsurance partners

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Executive Summary

Group health underwriting, including stop loss, level funding, captive, and excess of loss reinsurance, remains one of the most complex and capital-sensitive functions within the health insurance ecosystem. Despite robust and established actuarial processes, carriers continue to experience unexpected losses driven by claim volatility, concentration risk, and limited visibility into prospective group-level risk.

This white paper presents findings from a **retrospective underwriting study conducted with a leading national stop-loss carrier**, evaluating whether **Merit Predict**, an AI-led predictive analytics platform developed by Merit Medicine, could have improved underwriting decisions and financial outcomes.

The study analyzed **19 employer groups across 16,823 covered members** that were originally underwritten and bound by the carrier. A subset of these groups ultimately produced materially worse-than-expected results for the carrier, with premiums failing to exceed reimbursements in several cases.

When these same groups were evaluated retrospectively using Merit Predict, the platform successfully identified the majority of groups that would have unexpected losses **prior to underwriting**, flagging them as **highest-risk Tier 5 groups**.

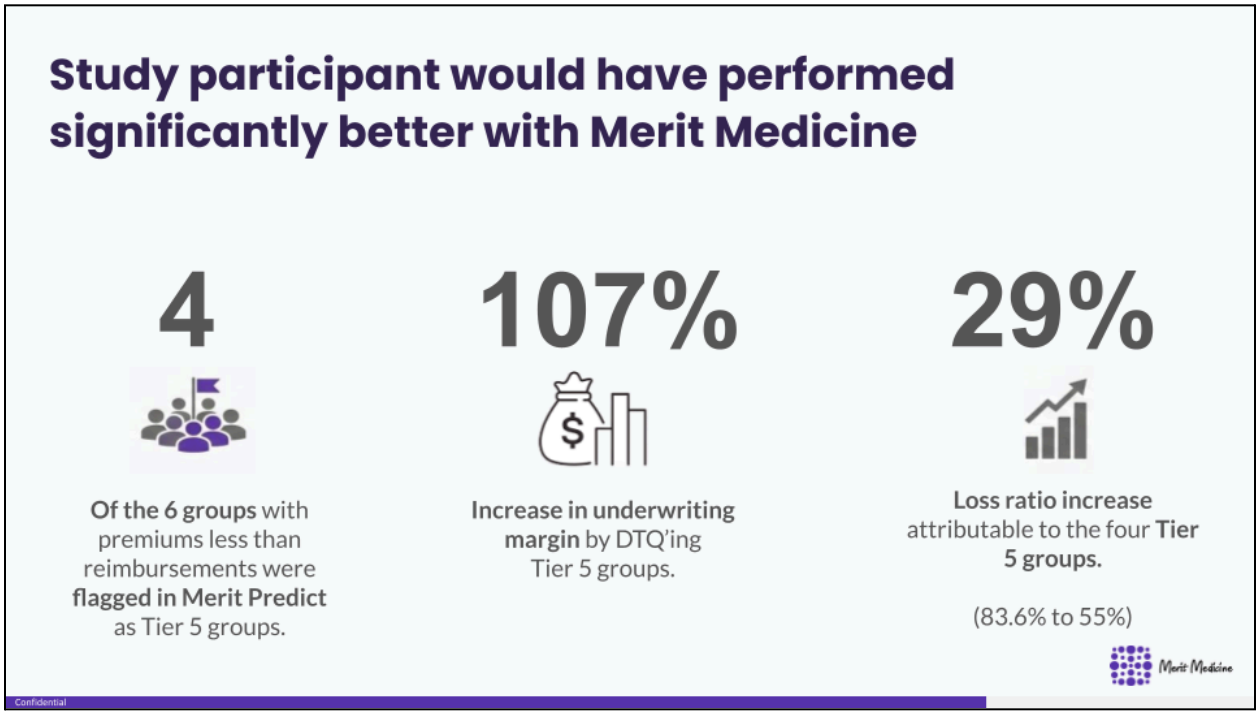
Key findings include:

- Six of nineteen groups represented 67.4% of total reimbursements and generated loss ratios greater than 100%, indicating systematic underpricing relative to realized claims.
- Merit Predict identified **four groups as Tier 5 (highest risk)** and **all four** of these groups were among the six that drove material losses for the carrier.
- Although Tier 5 groups represented a minority of total groups, they accounted for **52% in underwriting losses before expenses.**
- Excluding or repricing of Tier 5 groups would have **improved the total Loss Ratio from 83.6% to 55% and increased Profit Margin from 16.4% to 45%.**
- The implied ROI of Merit Predict exceeded **6.9x relative to annual platform cost.**

These results demonstrate the potential for AI-driven risk stratification to materially improve underwriting discipline, reduce downside exposure, and enhance portfolio-level profitability. Beyond loss avoidance, improved risk stratification enables more confident and competitive pricing for low- and moderate-risk groups. By isolating and appropriately pricing Tier 4 and Tier 5 volatility, carriers can be more aggressive on Tier 1–3 risks—improving quote competitiveness, win rates, and portfolio growth without increasing overall capital exposure.

Importantly, while this analysis focuses on a stop-loss use case, the findings are broadly applicable to any organization exposed to medical claim volatility. Managing tail risk, earnings volatility, and capital efficiency is a shared challenge across stop-loss carriers, MGUs, primary health insurers, and reinsurance partners. Predictive risk stratification provides a scalable, defensible framework to improve pre-bind decision-making across the risk-bearing ecosystem.

Figure 1. Study participant would have performed significantly better with Merit Predict



Background: The Challenge of Volatility and Tail Risk in Health Insurance Portfolios

Stop-loss carriers operate in an environment where **a small number of high-cost claims can disproportionately impact results**, particularly for small and mid-sized employer groups. Traditional underwriting inputs—claims history (when available), demographics, and basic actuarial adjustments—often struggle to fully capture:

- Claim volatility and tail risk
- Concentration of catastrophic exposure

- The predictability of future claim patterns
- Capital strain and earnings volatility driven by a small number of extreme outliers

As a result, carriers may unintentionally underprice groups that appear attractive on the surface but exhibit structural risk characteristics that increase the likelihood of outsized reimbursements.

Conversely, the opposite dynamic can also occur: a group may appear highly risky based solely on the trailing 12 months of claims experience, yet prospectively exhibit stable and predictable risk characteristics. In these cases, carriers that can accurately distinguish temporary claim spikes from structural volatility are positioned to price competitively with a high likelihood of winning the bid while still achieving profitability targets. More broadly, the ability to isolate truly volatile groups enables carriers to be more aggressive across lower-risk segments—improving win rates, top-line revenue growth, and overall margin across the portfolio without increasing aggregate capital exposure.

These dynamics not only affect underwriting margin, but also distort capital planning, reserve adequacy, and reinsurance performance—making early identification of volatility risk critical across the insurance value chain.

The goal of this study was to evaluate whether **advanced predictive analytics**, applied prior to underwriting decisions, could have meaningfully improved risk selection.

Study Overview and Methodology

Study Population

- **19 employer groups (curated by carrier)**
- **16,823 covered members**
- **Analysis type:** Retrospective predictive risk analysis
- **Platform:** Merit Predict (AI-led risk scoring and member-level predictive insights)

All groups were originally quoted, bound, and assumed to be profitable by the carrier at the time of underwriting.

Merit Predict Evaluation Framework

Each group was analyzed using Merit Predict's AI-driven models, with metrics generated at the **member level** and aggregated to the **group level**. Outputs included:

- **Merit Stop Loss Risk Score (Primary Risk)**

  Represents the group's coefficient of variance (CV), indicating how predictable the group's claim patterns are. Lower CV values reflect stable, predictable spend, while higher CV values indicate greater volatility and stop-loss exposure.

- **Merit Aggregate Risk Score (First-Dollar Risk)**

  Represents the group's overall aggregate risk compared to the national benchmark. A score above 1.0 indicates higher-than-average expected first-dollar healthcare spend, while a score below 1.0 indicates lower expected first-dollar spend.

- **Member-level Health Status Summaries**

  Clinical notes about the current healthcare disposition of each member in the group, Primary Diagnoses, and both *current and historical* High-Cost Drug usage.

- **Predicted Member-Level Medical & Pharmacy Spend**

Groups were ranked by risk and segmented into **five quintiles**, forming a standardized **risk tiering framework**:

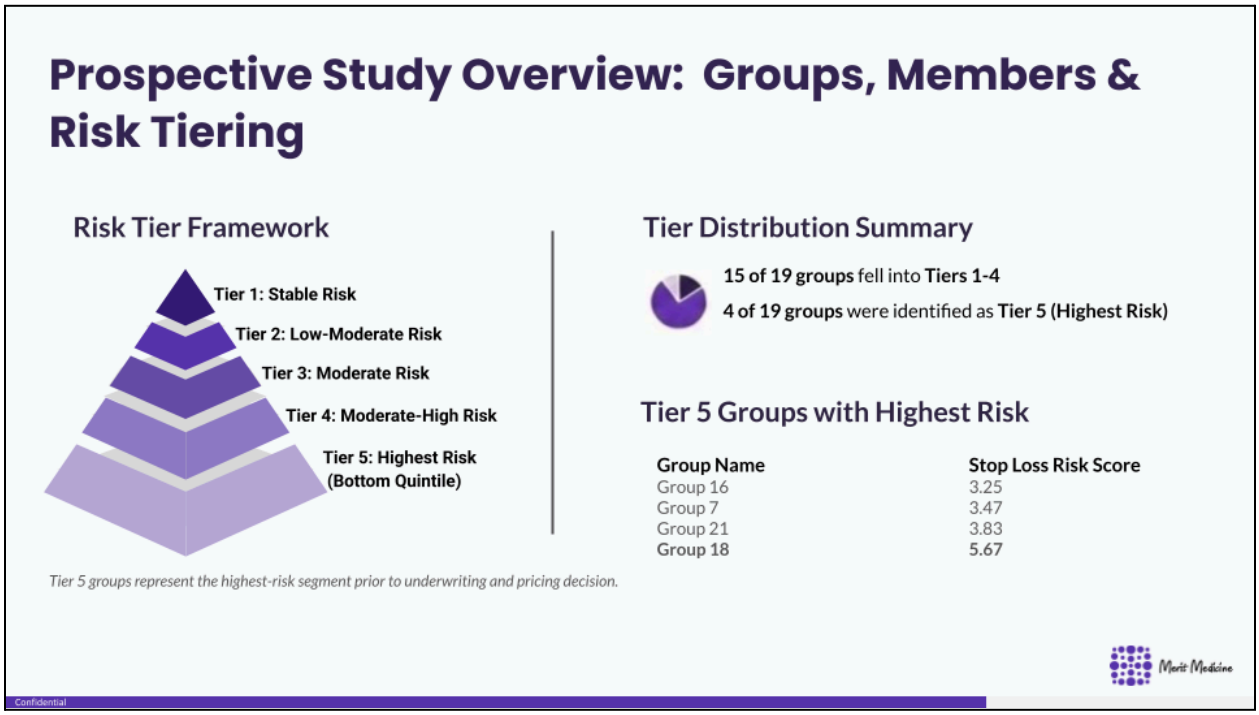
- Tier 1: Stable Risk
- Tier 2: Low–Moderate Risk
- Tier 3: Moderate Risk
- Tier 4: Moderate–High Risk
- Tier 5: Highest Risk (top quintile)

Methodological Considerations

This study was conducted retrospectively to evaluate whether predictive risk insights available prior to underwriting could have altered decision-making outcomes. Merit Predict scores were generated using only data available at or before the time of underwriting and did not incorporate post-bind claims experience.

As with any retrospective analysis, results are directionally indicative and intended to evaluate risk identification capability—not to suggest deterministic pricing outcomes. Merit Predict is designed to augment actuarial judgment by improving visibility into volatility risk, not to replace underwriting discipline or actuarial methodologies.

Figure 2. Merit Predict risk tiering framework and tier distribution



Identifying these bottom quintile groups would have allowed the carrier to DTQ or price the risk out of the bid.

Key Findings: Loss Concentration and Risk Stratification

From an actuarial perspective, the results highlight a classic loss concentration pattern, where a small subset of risks drives a disproportionate share of portfolio volatility and capital consumption.

Risk Tier Distribution

- **15 of 19 groups** fell into Tiers 1–4
- **4 of 19 groups** were classified as Tier 5 (highest risk)

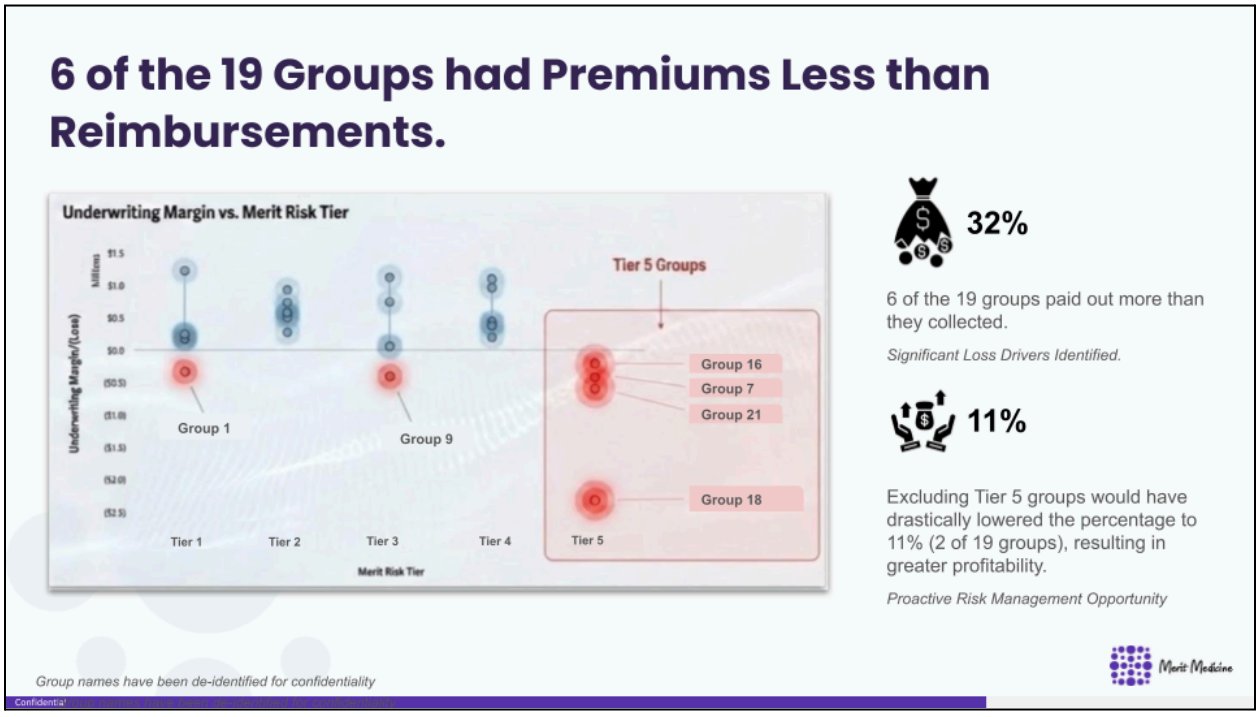
Tier 5 groups represented the most volatile and unpredictable claim profiles prior to any underwriting or pricing decisions. These groups exhibited materially higher coefficients of variance (**Merit Stop Loss Risk Score**), indicating elevated tail risk and a higher probability of extreme loss outcomes relative to premium.

Underwriting Performance Outcomes

Despite representing only **21% of the cohort groups and 31% of members**, Tier 5 groups drove a disproportionate share of losses:

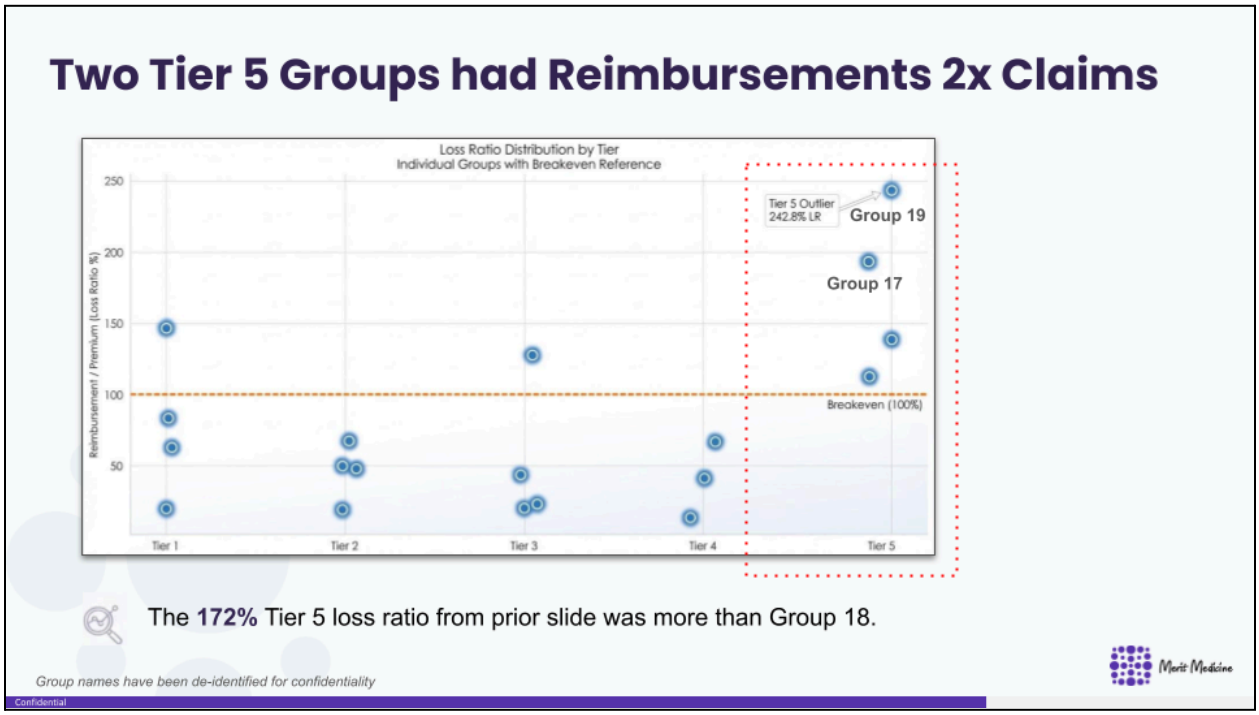
- **6 groups** had premiums lower than reimbursements
- **4 of those 6 groups** were Tier 5
- Tier 5 groups resulted in Loss Ratio of 171.9% with Tier 1-4 Loss Ratio of 55%
- Loss ratio for Tier 5 groups was nearly **3x higher** (312%) than the rest of the cohort
- Tier 5 PMPMs were 145% higher than the average across the total population and reimbursed at 160% higher than average

Figure 3. Underwriting margin versus risk tier



Two Tier 5 groups experienced reimbursements that were **172% more than their collected premiums**, significantly distorting portfolio-level results.

Figure 4. Tier 5 groups with reimbursements exceeding 2× premiums



Concentration of Losses

The **four highest-risk Tier 5 groups** collectively generated **52% in underwriting losses.**

The largest single loss—**Group 18 at $2.3M**—had a Stop-Loss Risk Score **1.5x higher than any other group** in the study, highlighting the platform's ability to surface extreme outliers.

Figure 5. Losses among the four highest-risk Tier 5 groups

Financial Impact Analysis

Hypothetical Underwriting Scenarios

If Merit Predict had been available during underwriting, the carrier could have reasonably applied differentiated underwriting actions based on risk tier, including:

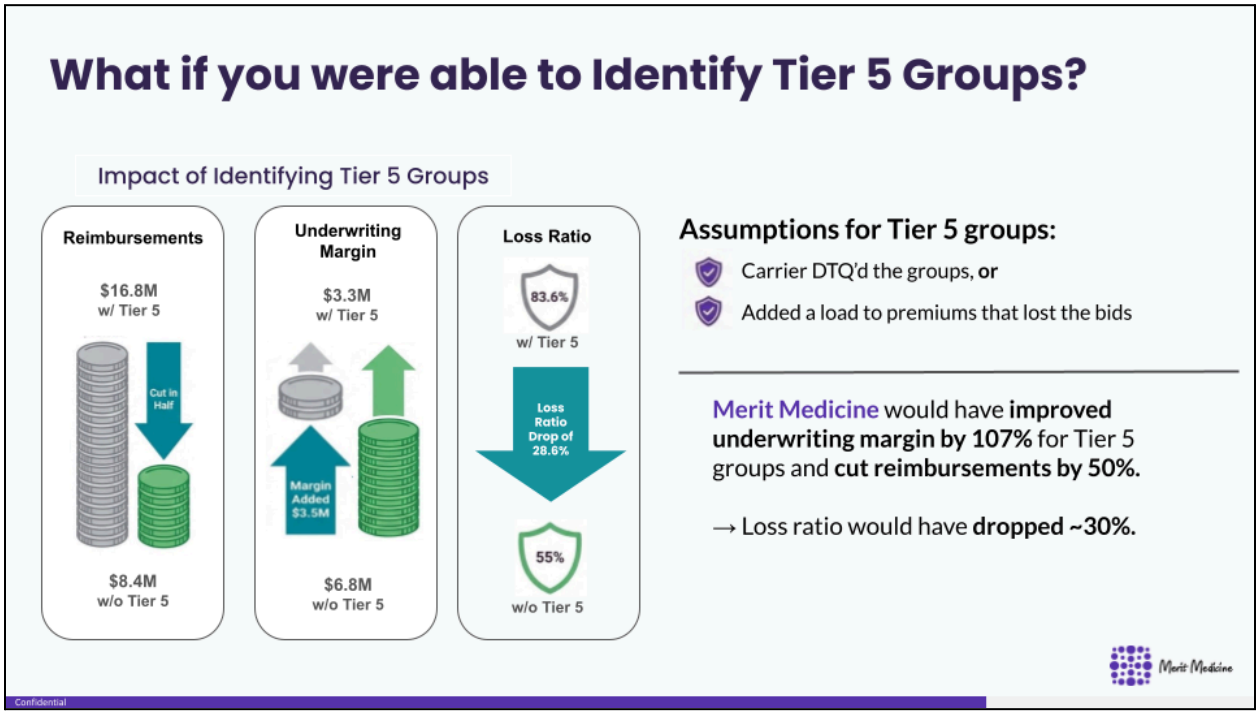
- Competitive pricing for Tier 1–2 groups
- Moderate pricing adjustments or tighter contract terms for Tier 3–4 groups
- Declining to quote Tier 5 groups (DTQ) or applying premium loads sufficient to reflect extreme volatility risk

Equally important, clearer separation of high-volatility Tier 4 and Tier 5 risks enables underwriters to apply tighter pricing confidence bands to Tier 1–3 groups. Rather than conservatively loading all risks to compensate for unseen tail exposure, carriers can selectively concentrate margin where volatility truly resides—supporting more competitive pricing on attractive groups while maintaining overall portfolio discipline.

Under these assumptions:

- **107% Improved underwriting margin**
- Reimbursements would have been reduced by approximately **50%**
- Portfolio loss ratio would have declined by **~30%**

Figure 6. Modeled financial impact of identifying Tier 5 groups prior to binding



ROI of Merit Predict

To contextualize the investment required:

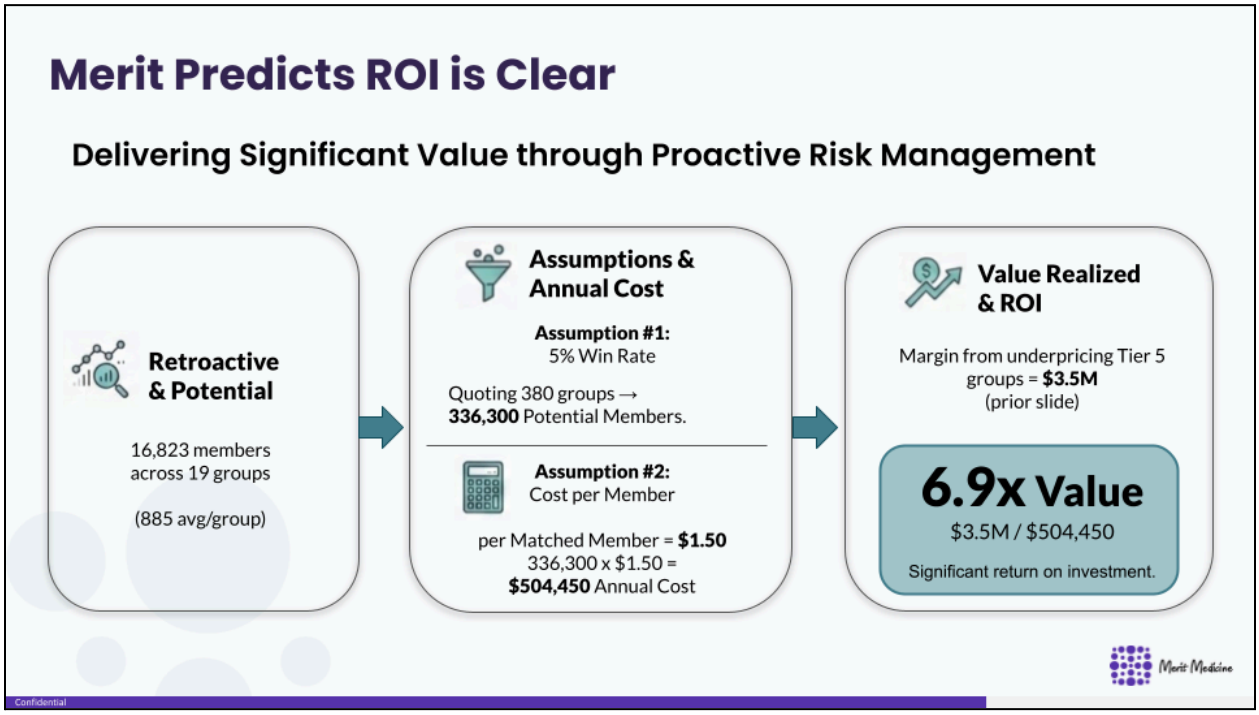
- RFQ-to-bind win rate assumed at **5%**
- Winning 19 groups requires quoting approximately **380 groups**
- Total potential members evaluated: **~336,300**
- Estimated Merit Predict cost: **$1.50 per member** (pricing based on large carrier volume)
- **Annual platform cost:** ~$504,450

Value delivered:

- $3.5M in avoided losses ÷ $504,450 cost to run Merit Predict
- **≈ 6.9x return on investment**

This estimate excludes secondary benefits such as improved pricing discipline, capital efficiency, opportunities for lasering, and underwriting consistency.

Figure 7. Estimated ROI of Merit Predict



Strategic Implications for Risk-Bearing Organizations

1. Stop-Loss Carriers

Predictive risk stratification enables earlier identification of volatility risk, supporting stronger pricing discipline, reduced tail exposure, and more stable portfolio-level results.

Predictive risk stratification does not simply reduce losses—it reshapes pricing behavior. When Tier 4 and Tier 5 volatility is more precisely identified and priced,

underwriters can confidently lean into Tier 1–3 opportunities without relying on conservative portfolio-wide margins. This enables more aggressive, targeted pricing on high-quality risks, improved quote competitiveness, and higher-quality growth—while preserving capital and earnings stability.

2. MGUs

For MGUs operating under delegated underwriting authority, predictive analytics provide a defensible and auditable framework for risk selection and pricing decisions. Enhanced visibility into volatility risk strengthens credibility with carrier partners, supports consistent underwriting discipline across teams, and helps preserve long-term capacity relationships by reducing the likelihood of headline losses.

3. Captives

Employer and group captives are particularly sensitive to tail risk, as a small number of extreme claims can rapidly erode surplus, disrupt funding strategies, and require unexpected capital calls from members. Predictive risk stratification enables captives to more effectively evaluate prospective members, set appropriate attachment points and funding levels, and proactively manage volatility exposure—supporting long-term sustainability and member confidence.

4. Reinsurers and Capital Providers

Reinsurers benefit from improved cedent risk selection, reduced treaty volatility, and more efficient capital deployment. Predictive risk stratification can serve as a governance layer that enhances portfolio quality before risk is transferred.

This retrospective analysis highlights several important implications:

1. **Losses are highly concentrated** among a small subset of high-risk groups
2. Traditional underwriting processes struggle to identify volatility risk early
3. AI-led predictive analytics can meaningfully enhance pre-bind decision-making
4. Avoiding just a few high-risk groups can materially improve portfolio outcomes

Merit Predict does not replace actuarial judgement—it augments it with earlier, deeper, and more comprehensive risk insight.

Conclusion

The findings from this retrospective case study demonstrate that **Merit Predict could have materially improved underwriting outcomes** for a national stop-loss carrier by proactively identifying groups with elevated volatility and stop-loss exposure.

By flagging the highest-risk groups prior to pricing and binding, carriers can:

- Reduce unexpected reimbursements
- Improve underwriting margin
- Stabilize loss ratios
- Achieve a strong, defensible ROI on analytics investment

As underwriting margins tighten and capital efficiency becomes increasingly critical, predictive analytics represent not just a competitive advantage, but an emerging best practice for disciplined risk selection and early intervention across the health insurance ecosystem.

About Merit Medicine

Merit Medicine is a healthcare analytics company focused on delivering **AI-led predictive insights** that help carriers, captives, consultants, and employers better understand and manage group health risk.

Merit Predict combines advanced AI and machine learning, and clinical intelligence, to deliver actionable underwriting and risk selection insights—before losses occur.

Want to learn more about Merit Medicine? We would love to hear from you!

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About Axene Health Partners (Third-Party Validator)

Axene Health Partners (AHP) is an independent health actuarial consulting firm focused on helping organizations understand, manage, and predict healthcare costs. AHP emphasizes **data-driven insights, analytical rigor, and practical strategies** that help clients navigate the

financial and operational complexities of healthcare while improving quality of care and controlling costs.

Want to learn more about Axene Health Partners?

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