Effectiveness of Care Management for Reducing ED Utilization: Application of a Novel Risk Stratification Tool to Find Impactable Utilization

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KEY POINTS FROM THIS BRIEF:

- Community Care of North Carolina (CCNC) has developed an ED Risk Score for flagging patients in the Emergency Department (ED) with a higher likelihood of returning to the ED. The purpose of this evaluation was to leverage this new risk stratification tool in order to quantify the estimated benefit from care management for patients retrospectively discharged from the ED.

- Looking at a year of claims data from July 2023 – June 2024, we evaluated the impact of our care management intervention on reducing ED utilization following an index ED visit, both overall and stratified by ED Risk Score.

- We found that the impact of care management was low to non-existent among members with low risk of returning to the ED, but statistically significant among members with greater propensity for returning to the ED.

- For patients in the highest ED Risk strata, we found that we prevented one ED visit for every 5 patients that we care managed.

- Effective risk stratification is needed to ensure that care managers are managing the most impactable patients being discharged from the ED.

Background

Reducing Emergency Department (ED) utilization among Medicaid recipients remains a critical priority for healthcare systems. In response, many evaluations of the effectiveness of care management for reducing ED utilization have been conducted, with mixed outcomes. The CHECK Trial utilized a randomized controlled trial with children and young adult Medicaid recipients with chronic diseases.[1] Although the overall results did not show a significant reduction in utilization due to care coordination, they found a trend toward significance when considering higher-risk cohorts. However, as "higher risk" still included large numbers of patients with relatively little historical ED utilization, it is not surprising that a statistically significant difference was not found. Similarly, results from a large observational study of

the effectiveness of a United Healthcare Complex Care Management program for Medicaid-eligible adults showed significant results, but only within specific higher-risk strata.[2,3] A smaller randomized study that focused specifically on high utilizers at baseline successfully demonstrated a statistically significant reduction in ED utilization compared to the control group.[4] However, there was no further stratification beyond the initial eligibility criteria of 5 or more ED visits, and the population only included a small subset of Medicaid beneficiaries. Other randomized controlled trials that did not utilize risk stratification were only able to demonstrate positive, but not statistically significant, trends.[5,6]

As is evident from research cases mentioned above, significant ED reduction outcomes seem to be limited to populations that are high risk, more complex, and/or have a significant history of high ED utilization. Others have mixed or no statistically significant ED reduction outcomes. Though the results have been mixed, there is still evidence that suggests that care management can play a meaningful role in reducing ED utilization, particularly when interventions are targeted to the right subgroups. As part of North Carolina Medicaid's Advanced Medical Home program, CCNC has been doing timely follow-up on high-risk ED visits. Given this growing evidence of the existing correlation between care management and reduced ED utilization, CCNC sought to refine that correlation with data points and machine learning that can enhance our ability to further reduce and refine ED utilization outcomes.

Findings

Intervention and Comparison Groups

The evaluation sample included a total of 46,940 unique patients enrolled in a Medicaid managed care plan who went to the ED at least once during the one-year period from July 1, 2023 – June 30, 2024. Of these, there were 3,153 (7%) patients in total who were identified for follow-up and who successfully received a care management outreach within 3 days of their ED visit (hereafter referred to as the "Intervention" group) and 43,787 patients (93%) who received no attempted outreach (hereafter referred to as the "Comparison" group). The intervention was defined as having received completed outreach following the index ED visit. This outreach typically included a telephone call, telehealth visit, outpatient visit, case management contact, or behavioral health check-in. It was conducted by a clinical staff member — such as an RN, LPN, MA, PA, MD, or a licensed behavioral health provider. Care management activities included care coordination (e.g., scheduling primary care follow-ups), education on appropriate ED use, and referrals to address social determinants of health (e.g., transportation barriers). There was also a small group of patients who were approached but were not reached within 3 days; these individuals were excluded from both the intervention and comparison groups. The patients' first ED visit during the evaluation period was chosen as their Index Visit and the outcomes looked at the 90 days following the Index Visit.

Risk Stratification

We developed the ED Risk Score[7] – a proprietary predictive tool to identify patients at high risk for future ED utilization – AFTER the period being evaluated here. This score enabled effective risk stratification based on ED Return Rate, allowing us to assess the impact of care management interventions more precisely. However, it was not used for targeting care management during the evaluation period. As this was a non-randomized evaluation, we wanted to avoid doing a direct head-to-head comparison of patients who agreed to care management with those who did not, as such comparisons introduce significant bias. The ED Risk Score thus allowed us to do a meaningful comparison

between those who did and did not receive care management by evaluating the outcomes within a risk-stratified context.

At the time of the evaluation period reported here, prioritization for ED follow-up was primarily driven by risk stratification indicators provided by the Medicaid Managed Care plans. Per the requirements of the Advanced Medical Home program, care managers were expected to reach out to every patient deemed as high risk per the plans. While there was understandably some correlation between our ED Risk Score (which was developed much later) and the plans' risk stratification, there was still a sizable cohort not flagged for follow-up by the plans. Although care managers did not have access to the ED Risk Score during the intervention period, its retrospective application provided valuable insights into the effectiveness of care management and the importance of predictive analytics in guiding resource allocation.

Figure 1 illustrates the percentage breakdown of ED patients across risk strata included in the intervention and comparison groups. Risk scores range from low to high, with 1,000 representing the highest-risk patients. Across all strata, the comparison group consistently comprises the majority—generally exceeding 80%—indicating that most members did not receive timely care management intervention. While the proportion of members in the intervention group increases modestly in higher-risk strata, a substantial gap remains, even among individuals identified as high-risk. This pattern highlights a significant opportunity to improve post-ED follow-up care for patients most likely to return to the ED.

Figure 1: Percent of Members within each Risk Strata who were Included in the Intervention and Comparison Group
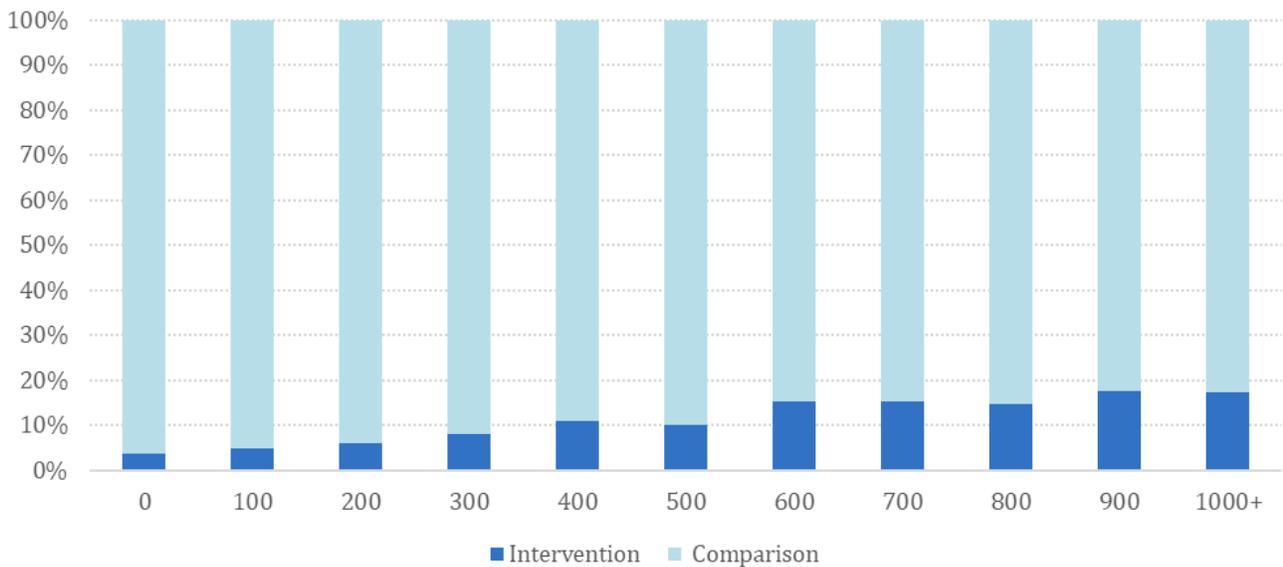
Table 1 presents the characteristics of the study sample. Patients in the intervention group exhibited traits commonly associated with higher ED return risk—older age, greater clinical complexity, and substantially higher prior ED utilization—highlighting the need for risk stratification to ensure fair comparisons. This is best exemplified by the percent of members tagged as multimorbidity of either high or medium complexity. This indicator was derived by the Johns Hopkins ACG® System which sorts members into varying patient need groups.

Table 1: Characteristics of Patients in the Intervention and Comparison Groups

| Characteristic	Intervention Group	Comparison Group
Total N	3,153	43,787
Mean Age	24.3	19.0
% Female	61.1	53.7
% Hispanic	17.6	21.9
% White	43.6	45.4
% Black	46.8	44.6
% Non-Emergent	16.4	19.0
% Tobacco Use	16.8	12.2
% Substance Use	6.2	4.0
% Major Psychiatric Condition	18.4	10.3
% High Social Vulnerability	54.6	57.6
% Multi-Morbidity High/Medium Complexity	36.0	26.0
ED Utilization in the Prior Year (Rate per members)	767.2	493.4

The primary outcome for this evaluation was the ED Return Rate, defined as the number of additional ED visits incurred within 90 days following the Index visit, expressed as an annualized rate per 1,000 members. This rate-based approach was chosen over a binary outcome to capture the intensity of ED recidivism, recognizing that one return visit often leads to multiple subsequent visits. In the final regression model, the ED Risk Score was a strong and statistically significant predictor of ED return ($p < .0001$). Additionally, while the Group variable (intervention group compared to comparison group) by itself was not statistically significant, the interaction between Group and ED Risk Score was highly significant ($p < .0001$), suggesting that the effectiveness of care management increased as the patient's ED Risk Score increased.

Table 2: Regression Model Estimates for Predicting ED Return

Variable	Coefficient	p-value
Intercept	0.0528	< 0.001
Intervention Group	-0.0118	0.54
ED Risk Score	0.0010	< 0.001
Intervention Group x ED Risk Score Interaction	-0.0002	< 0.001
Payer	0.0755	< 0.001
Female	-0.0519	< 0.001
Age	0.0007	< 0.01
Hispanic	-0.0037	0.66
Black	0.0275	< 0.05
White	-0.0011	0.92

Figure 2 illustrates the effect of the interaction term. Specifically, the difference in ED Return Rate between the two Groups (y-axis) increased significantly as the ED Risk Score (x-axis) increased. In the lowest risk strata (less than 200), the differences between the two groups was virtually non-existent, but the difference between the two groups was substantial when considering those in the highest risk strata (500 and above); ED Risk Scores in the middle range (200-499) were associated with a modest reduction. The resulting "number needed to treat" suggests that 20 patients in the middle range would need to be care managed in order to prevent one ED visit, but only 5 patients in the highest strata would need to be care managed in order to prevent one ED visit. Again, there was no discernible benefit from care management for those in the lowest risk strata. The results for additional terms in the model are described in the appendix.

Figure 2: Estimated Impact of Care Management on Reducing ED Utilization
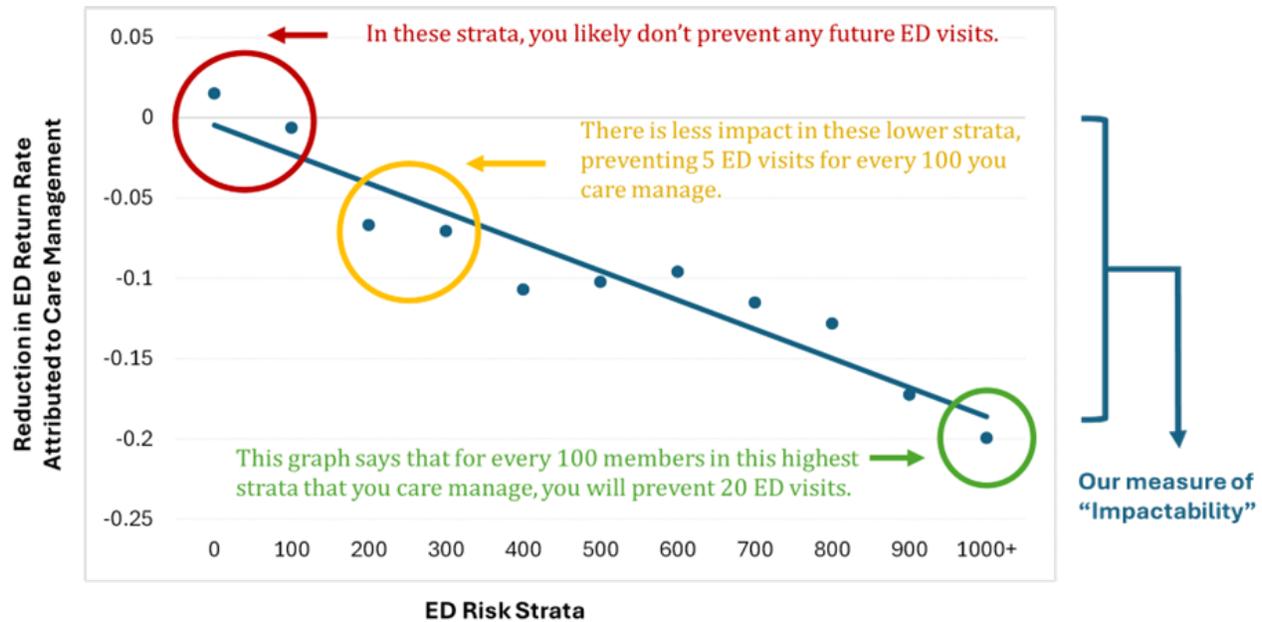
Discussion and Conclusion

Care management can have a meaningful impact on future ED utilization when applied judiciously. For those members in the lowest risk cohort, care management made almost no difference in terms of returning to the ED. On the other hand, the much smaller, highest risk cohorts experienced measurable improvement in future ED utilization as measured by the ED Return Rate. As previously reported, patients in the highest risk cohort were generally characterized as having greater clinical complexity as well as a history of repeat visits to the ED. Factors that were not associated with a high ED Risk score were indicators of "avoidableness" associated with the index visits. Indeed, there was no difference in the outcome whether the index visit or any of the prior visits were deemed "emergent" or "non-emergent."

This study reinforces the critical role of targeted care management in reducing emergency department (ED) utilization. While there was limited impact overall, a small cohort with a particularly high propensity for returning to the ED demonstrated a significant benefit from care management. By leveraging predictive analytics, CCNC was able to stratify patients and identify those with the greatest propensity for returning to the ED and most likely to benefit from care management interventions. The findings show that care management did not significantly reduce ED return rates across the entire population. However, its effectiveness increased substantially among patients with higher ED Risk Scores. The estimated return on investment for this most impactable cohort was the equivalent of one averted ED visit for every 5 patients who were managed with as little as a single phone call. This interaction underscores the importance of risk stratification in deploying limited care management resources efficiently.

Any evaluation of the effectiveness of an intervention for reducing ED utilization must account for the variable underlying risk of the target population. Indeed, if one were to look at the ED Return Rate of the highest risk cohort, it would appear that there was no change pre-post for patients in that group. Conversely, without adequate risk stratification, the lowest risk population would falsely appear to be the most impacted population by virtue of their low ED Return Rate. However, only an effective risk stratification approach, coupled with an unbiased comparison group, would demonstrate the meaningful difference-in-difference needed to establish the efficacy of the intervention.

Appendix

Data Sources

Data was derived from paid claims data, beneficiary files and data from CCNC's care management application. While ED visit records for this evaluation were derived primarily from claims data, ADT (admission, discharge, and transfer) data formed the basis for care management interactions. ADT data was predominantly obtained from NC HealthConnex (North Carolina's state health information exchange), with supplementary data for a subset of the membership from a commercially available source. Collectively, these two sources capture ED visit information from over 1,000 healthcare facilities located within the state of North Carolina. Johns Hopkins ACG® System was used to assess patient complexity through Patient Need Groups (PNGs), which account for overall clinical burden, including comorbidities, medications, and procedures. Social vulnerability variables were obtained from the CDC/ATSDR Social Vulnerability Index (SVI) 2022 database. Clinical characteristics included comorbidities, major psychiatric conditions, tobacco use, and substance use. The sample data included 46,940 unique patients who visited the ED at least once between July 1, 2023, and June 30, 2024. The data used for the follow-up period extended to September 30, 2024, to allow for the full 90 days after the last Index Visit.

Statistical Methodology

To statistically evaluate the impact of care management across the ED Risk strata, we conducted a series of linear regression models that included the two main effects which were the group variable (Intervention vs. Comparison) and the patient's individual ED Risk Score, followed by the interaction between Group and ED Risk Score. We started with a first model that included just the two main effects plus the interaction term, followed by two subsequent models to further control for payer, sex, age, ethnicity, and race (second model), and a final model including the remaining terms (Socioeconomic Status and emergent status). The third model was not statistically significantly better than the second model and did not change the significance of the main effects and interaction term. Because Model 3 was not statistically significantly different from Model 2, we chose Model 2 as the final model. The final model (Model 2) revealed a significant interaction between care management and ED Risk Score ($p < 0.0001$), indicating that the intervention was effective in reducing ED return rates only among high-risk patients (Score ≥ 330), with no significant effect observed in lower-risk subgroups ($p = 0.5418$). The model demonstrated strong performance (F = 562.13, $p < 0.0001$), with significant predictors including payer ($p < 0.0001$), gender ($p < 0.0001$), age ($p = 0.0009$), Black race ($p = 0.0085$), and ED Risk Score ($p < 0.0001$).

It's worth noting that the follow-up rates were 20% (95% CI: 0.71-0.89) lower for one payer over another. It's unclear why that was the case for this particular analysis. It's possible that one plan implemented different incentives for practices to engage patients, or one payer may have had more claims denials. Either way, the trends were similar across both payers, and our analysis controls for these differences. Additionally, a small fraction of the sample had received outreach following a recent inpatient or ED discharge (6.9% and 1.5% of the total sample, respectively, had had an ED or inpatient discharge in the 30 days prior to receiving outreach). Although the focus of the paper wasn't on these special cases, we recognize they may have had some unique impact on the results. However, when removing these small subset of patients from the analyses, there was no difference in the overall story.

Suggested Citation

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