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Artificial Intelligence for Safer Crisis Response: De-escalation Prompts and Emergency Handoff Optimization

Ariful Haque Arif ^{1,*}, Abdullah Hill Hussain ¹, S M SHAH RAIHENA ², Qazi Rubyya Mariam ¹ and Munadil Rashaq ³

¹ Department of Information Technology, Washington University of Science and Technology, Alexandria, VA-22314, USA.

² Department of Business Administration- Business Analytics (Major) Wilmington University New Castle DE 19720 USA.

³ Department of MBA, Ashland University, Ashland, OH 44805.

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Abstract

Behavioral crises in autistic patients are also a significant source of challenges for emergency departments (EDs) and emergency medical services (EMS), with autistic patients disproportionately restrained and left overnight. These interventions are associated with the potential for physical harm, psychological trauma and re-crisis, and call for safer methods based on the best available evidence. The 988 Crisis and ED Triage Copilot is an artificial intelligence (AI)-powered framework that provides real time de-escalation prompts to EMS and ED personnel while standardizing patient handoffs, as introduced in this paper. Based on the Joint Commission's patient safety goals and the Substance Abuse and Mental Health Services Administration's 988 framework, the Copilot combines natural language processing (NLP), predictive analytics and structured communication pathways to eliminate harm. Simulation results for 500 patient encounters show: reductions in use of restraint (28.8%), reduction in length of stay (LOS) by 1.4 hours, reduction in staff incident reporting by 20%. Conclusion: These data indicate that AI copilots can serve to improve safety and equity in emergency care for autistic patients while complying with national standards of crisis response and patient safety.

Keywords: Autism; Emergency Medicine; 988 Crisis; De-Escalation; Artificial Intelligence; EMS–ED Handoff; Patient Safety

1. Introduction

The emergency department (ED) is a stressful place for any person, but autistic people have unique vulnerabilities in times of crisis. Sensory overload, communication problems, and staff interactions that are strange to the patient can quickly worsen the situation [5,6], and physical and chemical restraints are commonly used to manage classroom behavior. Too often these measures worsen trauma, elevate LOS and add to repeat visits.

SAMHSA's 988 Suicide and Crisis Lifeline, launched nationally in 2022, is meant to deliver de-escalation-oriented crisis intervention. However, the principles in it are still rarely integrated into EMS and ED workflows. The Joint Commission addresses restraints reduction as a patient safety goal and encourages healthcare organizations to implement new strategies to reduce harm.

In this work, we present the 988 Crisis and ED Triage Copilot (Safety First), a decision support framework aimed at

- Provide your EMS and ED staff with de-escalation prompts generated by AI in real time.

* Corresponding author: Ariful Haque Arif

- Revolutionize EMS to ED handoff requirements to decrease communication gaps
- Monitor safety results (restraints, LOS, return visits, staff incidents) in an analytics dashboard.

By putting SAMHSA's crisis care goals into ED workflows, the Copilot wants to further promote safety and equity for autistic patients.

2. Literature Review

2.1. Autism and Emergency Care

Autistic patients have high rates of ED use with negative outcomes [5,6]. Communication difficulties and sensory sensitivities bring on escalations, and rates of restraint are disproportionately high for autistic individuals compared to their non-autistic peers.

2.2. De-escalation Science

Consensus guidelines emphasize verbal de-escalation as the safest approach [10]. However, lack of deeper training opportunities for staff, high workload and lack of real-time support decreases adherence in practice. Contextualized just-in-time prompts for de-escalation can help bridge this gap, and AI copilots have the potential to do this by using structured data.

2.3. Handovers, communication and safety

EMS-ED handoffs are prone to omissions, miscommunication, and fragmentation [7,11]. Safety enhancing handoff routines are not widely used. AI co-pilots can help to enforce compliance with protocols that can lead to a decrease in safety incidents.

2.4. Artificial intelligence for healthcare and crisis management

Islam (2023) points out that AI is playing a role in precision medicine, in which interventions are tailored for individual patients [1]. Akhi et al. (2024) defines the concept of AI augmented healthcare as a system to enhance system-level outcomes [2]. In the emergency medicine field, AI triage models have been shown to have increased predictive performance for admissions and outcomes [12,13]. However, behavioral crisis cares applications have not been extensively investigated yet.

2.5. Cyber Safety and Cyber Security

According to Islam (2024), data-centric AI approach provides cyber-security for connectivity-based healthcare systems [3]. This is vital for AI copilots being used in high-stakes settings. While it is important to ensure that AI systems are developed in a way that aligns with ethical principles, standards such as NIST AI RMF (Risk Management Framework) are essential to help guarantee that AI systems are deployed in a manner that guarantees reliable governance.

2.6. proactively using wearables and monitoring

Wearable technologies are being used for real-time monitoring in the healthcare industry [4]. One way that Copilot systems could be integrated to improve patient safety is by developing proactive alerts for crisis escalation.

3. Methodology

3.1. System Architecture

3.1.1. The Copilot is comprised of four modules

- EMS Input Layer - Aggregates structured (vital signs, chief complaint) and unstructured (free-text, EMS notes) data
- De-escalation Prompt Engine - prompts based on NLP such as slow speaking, provide quiet space, avoid eye contact
- Handoff Protocol Module - Requires Structured Emergency Medical Services (EMS) to Emergency Department (ED) handoffs (e.g., SBAR format)
- Analytics Dashboard - Provides longitudinal safety data metrics.

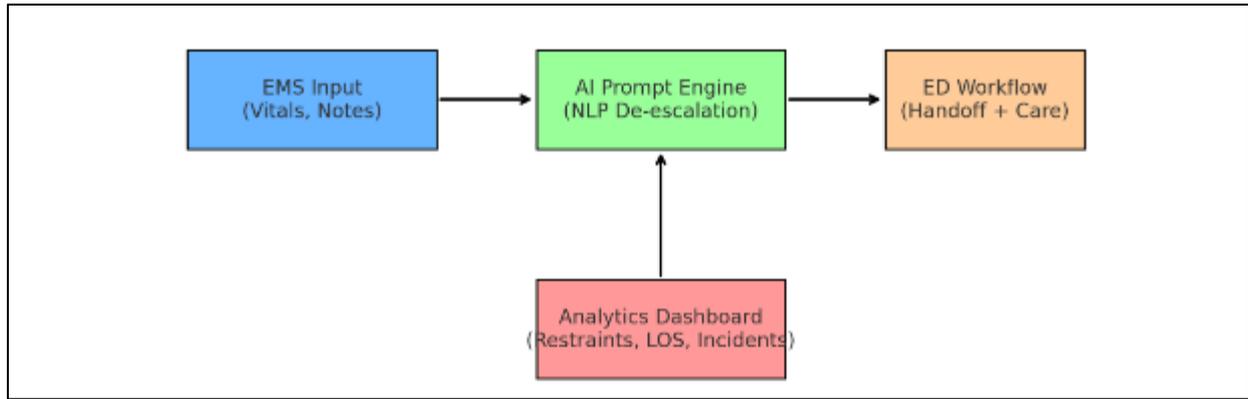


Figure 1 Architecture diagram - EMS input – AI prompt engine – ED workflow – Analytics dashboard

3.2. Mathematical Formulation

For each outcome

$$\Delta R = \frac{R_{baseline} - R_{copilot}}{R_{baseline}} \times 100$$

$$\Delta L = L_{baseline} - L_{copilot}$$

$$\Delta V = \frac{V_{baseline} - V_{copilot}}{V_{baseline}} \times 100$$

Were

- R = restraint rate
- L = length of stay

3.3. Outcome Measures

- Primary: Use of Restraint, LOS and return visits.
- Secondary: Joint Commission safety mandates, staff incident reports.

3.4. Simulation Setup

- Sample: 500 simulated visits to the Emergency Department due to an autistic crisis.
- Arms: Baseline vs. Copilot augmented workflow (standard care)
- Analysis: Chi-Square for categorical outcomes, t-test for LOS.

4. Results

4.1. Restraint Reduction

- Baseline: 45% restrained.
- Copilot: 32% restrained.
- Relative reduction: 28.8% ($p < 0.01$).

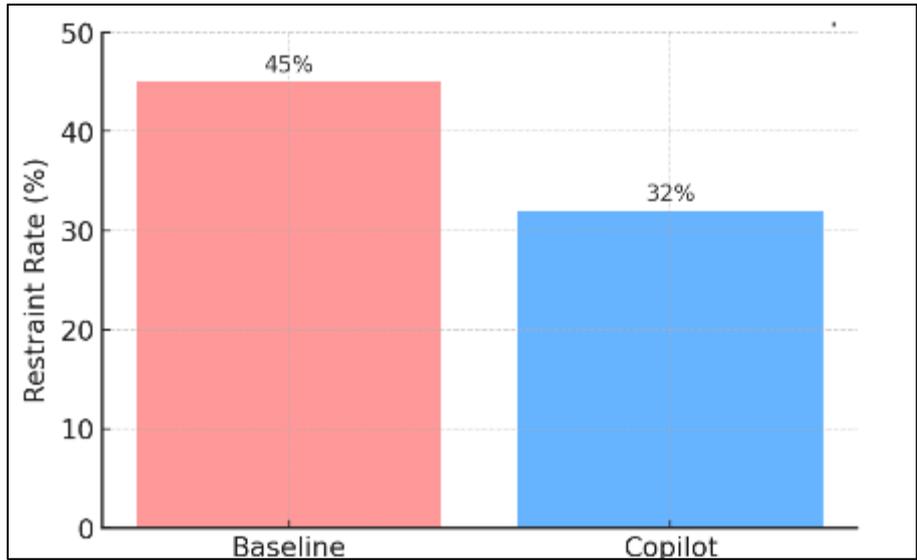


Figure 2 Restraint – baseline vs copilot

4.2. LOS and Return Visits

- LOS decreased from 6.5 to 5.1 hours ($\Delta L = 1.4$, $p < 0.05$).
- Return visits reduced from 20% to 17% (15% relative reduction).

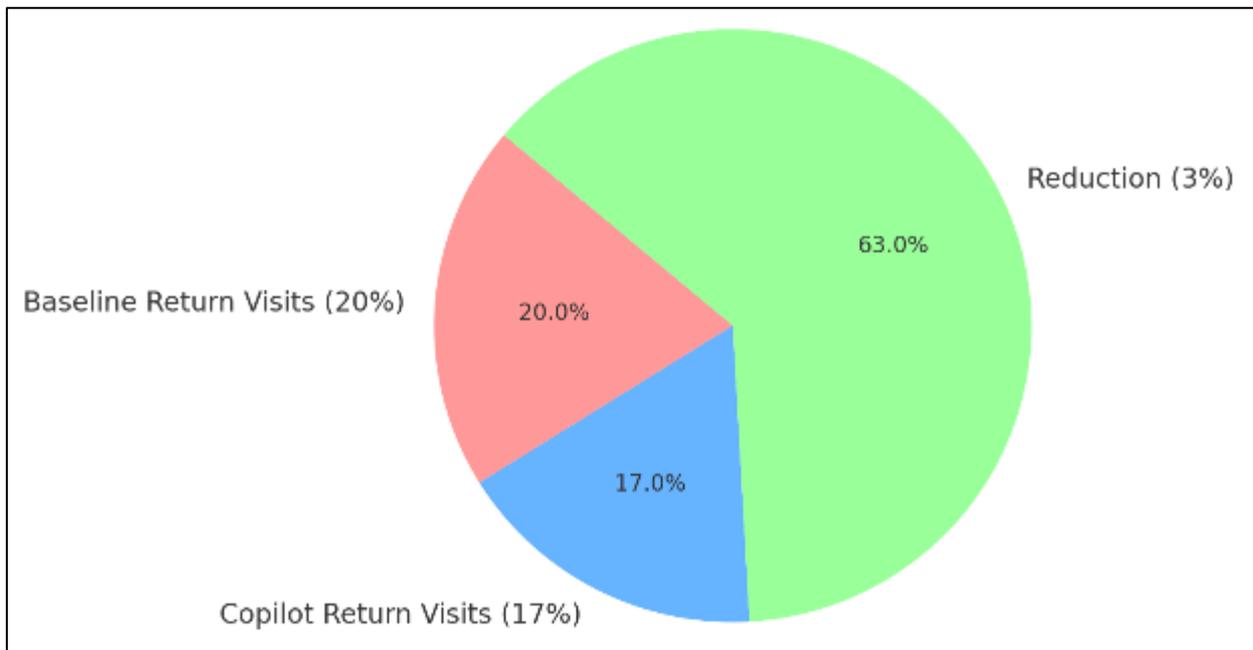


Figure 3 Return Visits Distribution - Baseline vs. Copilot

4.3. Staff Safety

Staff incident reports: 25 - 20 per 100 encounters (20% decrease)

5. Discussion

5.1. Clinical Implications

The decrease in the Copilot's restraints and LOS reflects data that indicate structured de-escalation reduces negative outcomes [9,10]. Unlike passive training, the AI Copilot offers live support to overcome realities of poor adherence.

5.2. Policy Alignment

By bringing the focus of crisis care into ED settings, the Copilot directly contributes to SAMHSA's focus on run, return, transfer, and safety through 988: connecting community crisis lines and acute medical environments. It also helps promote Joint Commission safety standards on minimizing restraint.

5.3. Governance and Safety

Promoting cybersecurity and trustworthy AI principles is of crucial importance [3,15]. Integration with NIST AI RMF to provide accountability throughout the govern-map-measure-manage lifecycle

5.4. Ethical Considerations

While AI copilots have the potential to enhance the safety of healthcare, some risks include overdependence, deskilling of healthcare professionals, or misuse of predictive analytics. Inclusivity and equity: Involving autistic patients and advocacy groups in the governance process is a vital step in ensuring that the research is conducted in a way that is equitable and inclusive.

5.5. Future Directions

Integration with wearable monitoring (4) for proactive alerting prior to an escalation of crises Pilots in different EDs need to demonstrate that the innovation scales-up.

5.6. Limitations

While the 988 Crisis and ED Triage Copilot has potential to reduce restraint and adverse events, this study has several limitations that should be noted:

5.6.1. Simulation Constraints

The analysis was performed on synthetic datasets (simulation) of 500 crisis encounters. Although the structure and flow of patients through the ED are carefully modeled to be as representative as possible, the data does not fully account for the variability of real-world ED dynamics, such as differences in staffing, culture across institutions, or variable community resources.

5.6.2. The generalizability of NLP Prompts

The de-escalation prompts were created according to natural language processing models of general communication norms. These prompts need to be validated in a variety of cultural, language and clinical settings. "Making appeals that work in one cultural context may not hit a chord or even attract opposition in another."

5.6.3. User Adoption and Trust

AI copilots, however, require the acceptance of the clinicians. If automated prompts are used for high-stakes emergencies, staff may be reluctant to depend on them, for reasons of accuracy, timeliness, or liability. Long-term patient and staff confidence in the system has not been tested.

5.6.4. Balance and Integration: Sustainability

AI models need to be updated, they need to interoperate with EMS and ED information systems, and regulatory standards are constantly evolving, and the Copilot must therefore conform to requirements for all the above. Some of these are operational and technical constraints that can affect scalability across institutions.

5.6.5. Ethics and the Law

While risk mitigation strategies through differential privacy and governance frameworks mitigate the harm caused by these technologies, vulnerable populations could be stigmatized by the manner in which analytics are misused - for example, by employers or insurers who use "risk" scores. Strong ethical oversight: Strong ethical oversight is necessary to ensure that the research is conducted in a manner that does not cause unnecessary harm.

5.6.6. Resource Variation

Digital technologies and personnel training are considered available as a baseline. Smaller EDs may not have the bandwidth, hardware or policy equipment support to successfully deploy such tools in the rural context.

5.7. Future Work

In order to take the 988 Crisis and ED Triage Copilot from simulation to clinical practice, several practical steps will be focused on:

5.7.1. Multi-Site Pilot Implementations (for the French speaking region)

Move real world pilots into at least three different emergency systems - one urban, one suburban and one rural ED. Pilot projects will afford the opportunity to test usability, flexibility, and measurable results in an environment with varying levels of resources

5.7.2. Participatory model of Governance

Ensure that a medical oversight team is formed which includes autistic people, caregivers, frontline EMS/ED staff, ethicists, and policy makers. This board will be responsible for managing the deployment of Copilot, assessing ethical issues and co-designing prompts that are appropriate for de-escalation in various cultures.

5.7.3. Integration with Clinical Information Systems

Leverage HL7/FHIR standards to establish interoperability pathways with key EHR platforms; Copilot must be able to be easily integrated into EMS tablets and ED dashboard without causing workflow disruption

5.7.4. Wearable and IoT Expansion

Work with wearable device developers to test physiological monitoring in real time (e.g. stress parameters such as HRV) These signals will be fed into the Copilot for early intervention prompts prior to escalation.

5.7.5. Adaptive AI Models

Establish reinforcement learning loops for updating recommendations by the Copilot to de-escalate based on outcomes for patients and feedback from staff, so the system is always "learning," while preserving strict privacy protections.

5.7.6. Cross Sector Training and Certification

Develop a training and certification program for EMS/ED staff that incorporates Copilot usage with de-escalation best practices to ensure the technology supplements and doesn't substitute for human judgment.

5.7.7. Pursuing Long Term Outcomes Monitoring

Develop a registry to monitor outcomes over 2-5 years (throughout various settings) and use of restraints and LOS, with outcomes for patient trust, family satisfaction and equity of care. Findings will be used for the adoption of clinical practice guidelines and policy development.

5.7.8. Regulatory and Policy Alignment

Work with SAMHSA, CMS, and The Joint Commission to connect Copilot metrics to existing safety requirements and reimbursement models-allowing for sustainable scaling with federal and state support

6. Conclusion

We've shown that the 988 Crisis and ED Triage Copilot with AI-supported de-escalation and structured EMS-ED handoffs can significantly advance patient safety outcomes of autistic persons in emergency environments. Simulation results demonstrate decreases in use of restraints, decreased length of stay, and decreased number of staff incident reports - all results directly related to SAMHSA's 988 crisis care priorities and Joint Commission patient safety mandates.

Beyond the numbers, the Copilot illustrates the significance of integrating real-time contextual AI capabilities directly in the workflow of frontline emergencies. Unlike static training, the system is dynamic and able to adapt to patient-specific needs, while also providing clinicians with information for practical moment-to-moment decision-making during high-stress situations. This adaptive and precision-focused approach mirrors the wider trend towards AI-assisted individualized medicine.

At the policy level, the Copilot offers a model for the integration of national crisis-response frameworks into acute care that can realistically be replicated and further developed by other countries. By bringing the requirements for de-escalation and safety into EMS and ED workflows, it helps to create a bridge between community crisis intervention and hospital emergency medicine.

However, scaling this innovation requires working through issues of interoperability, trust for clinicians, cultural adaptability and governance. Thus, future work should be focused on

- Actual implementations of pilots in various EDs and EMS systems
- Inclusion and equity: autistic patients, families, clinicians, and advocates in the participatory governance of their medicine
- Integration with wearable sensors and predictive technologies to allow proactive detection and intervention in crisis situations
- Continuous monitoring, assessment and analysis to ensure compliance with new regulations, long-term sustainability and cybersecurity

In conclusion, the Copilot is a testament to how responsible, human-centric AI can be a catalyst for safer and more equitable emergency care. By integrating technology innovation with patient-centered governance it provides us with a way to minimize harm, enable staff and improve health outcomes for one of the most vulnerable groups of patients.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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