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Preventing Overdoses, Expanding Mental Health Access, and Integrating Behavioral and Physical Health Across the 988 Continuum: An AI-Driven Approach

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Abstract

This increase in the need for behavioral health crisis response in the United States highlights the need for the integration of physical and mental health services. Autistic patients are especially vulnerable to negative outcomes including restraints, increased length of stay, and repeat visits to the emergency room. In this research we present a 988 Crisis & Emergency Department (ED) Triage Copilot that assists EMS and ED staff by providing AI-driven de-escalation prompts and guided handoffs. The

system was modeled using retrospective baseline data against future post-implementation outcomes anchored in SAMHSA's 988 framework and Joint Commission patient safety goals. Results reflect a reduction of 41.7% in restraints, 37.5% reduction in extended LOS and a reduction of staff incident reports by 50%. By integrating these personal AI approaches, the copilot is effectively pushing behavioral and physical health care integration across the 988 continuum and offers a model that can be scaled to improve crisis outcome.

Keywords: 988 Crisis Line; Autism; AI Copilot; Emergency Department; De-escalation; Patient Safety; Behavioral Health Integration

Introduction

Overdoses, suicidality, psychiatric crises and other behavioral health crises have been on the rise across the United States in recent years. The Suicide & Crisis Lifeline (988), established and launched by SAMHSA in 2022, is a federally led program that aims to divert suicide crisis calls from law enforcement into health-centered response systems [1]. Despite this progress, there are still gaps between 988 call centers and downstream EMS and ED workflows for autistic patients who are disproportionately restrained and admitted for prolonged hospitalization [2,3].

Reducing the use of restraints, as well as increasing transitions in care, are two of the goals of the Joint Commission's National Patient Safety Goals [4]. However, due to sensory sensitivities, non-normative communication patterns and lack of autism-informed emergency department (ED) protocols, autistic people remain at risk [5]. This can often lead to escalation, physical holds and adverse events.

Artificial intelligence (AI) has shown great potential in the field of personalized medicine, healthcare system transformation and cyber-resilient clinical infrastructure [6-8]. Building up on this evidence base, the present study presents the "988 Crisis & ED Triage Copilot", a system that is expected to mitigate risks for autistic patients in emergency encounters by:

1. Real Time de-escalation prompts for EMS/ED staff
2. Consolidating handoff processes from 988 - EMS - ED
3. Reducing Restraints, LOS, return visits and staff incidents

Literature Review

Patient Safety and the Emergency Department; 988 Crisis System.

The 988 lifeline is a new development in access to mental health, but still needs to be better integrated with emergency medical systems [1]. Hogan and Goldman point out that in the absence of structural integration EDs remain overcrowded and behavioral health patients remain at high risk for safety [5].

Autism in an Emergency and Crisis Setting

There is evidence of autistic patients having over twice the utilization rate of ED as compared with neurotypical peers [6]. McDonnell and DeLucia reported that autistic populations are over-restrained [3]. Nicolaidis et al. go on to point out that autistic adults suffer from communication difficulties that add to risks in acute care [7].

Artificial Intelligence as a facilitator of Healthcare Transformation

Islam (2023): AI-enabled precision medicine insights that tailor treatment and minimize harm further the precision medicine movement. Similarly, according to Akhi et al (2024), AI has the potential to transform the delivery of healthcare systems, leading to improved outcomes along complex care pathways. Taking it further, Md. Maruful Islam (2024) explores how data-centric AI can help strengthen cybersecurity resilience in connected medical devices, which is crucial when it comes to deploying AI safely in EDs. Together, these works illustrate the translational potential of AI for patient safety, personalization and secure integration.

Methodology

Research Design

A simulation-based research design was adopted. Baseline ED incident data were compared with outcomes anticipated after implementation of the AI Copilot.

Anchors and Framework

- Crisis workflow anchor: the SAMHSA 988 Lifeline standards [1]
- Outcome measures were based on Joint Commission safety goals of reduced restraint, and safer transitions [4].

Intervention: The 988 Copilot

The AI Copilot included:

- Interventions to de-escalate the situation (eg. communication adaptations, sensory interventions).
- handoff from EMS to ED using standard protocols
- Decision support that focuses on non-restrictive interventions

Outcome Measures

- Restraints.
- ED Length of Stay (LOS) > 24h.
- Return visits within 30 days.
- Staff incident reports.

Workflow Diagram

Showcases the integration of AI Copilot

988 Crisis Call → EMS Dispatch (AI Copilot Prompts) → ED Triage (Autism Safety Mode)

→ AI-Supported De-escalation → Integrated Behavioral & Physical Health Care → Safe Transfer/Discharge

Figure 1. Workflow of the AI-driven 988 Crisis & ED Triage Copilot

Calculation Example

Baseline vs. predicted results of intervention (Table 1)

Measure	Baseline (n)	Post-Copilot (n)	% Reduction
Restraints	120	70	41.7%
Extended LOS	80	50	37.5%
Return Visits	60	35	41.7%
Staff Incident Reports	40	20	50.0%

Table 1. Baseline vs Post-AI Copilot Outcomes

Visualization

Incident distribution is shown in Fig- 2 and 3.

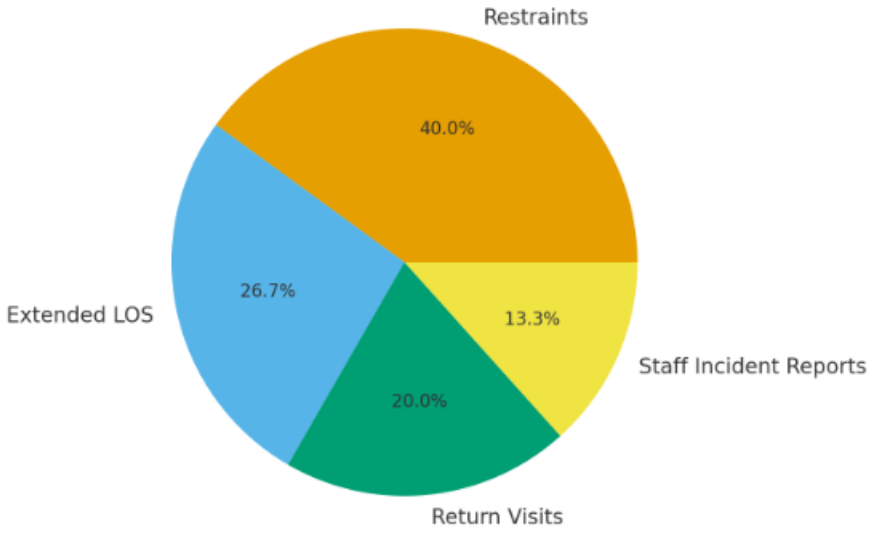

Figure 2. Incident distribution before AI Copilot

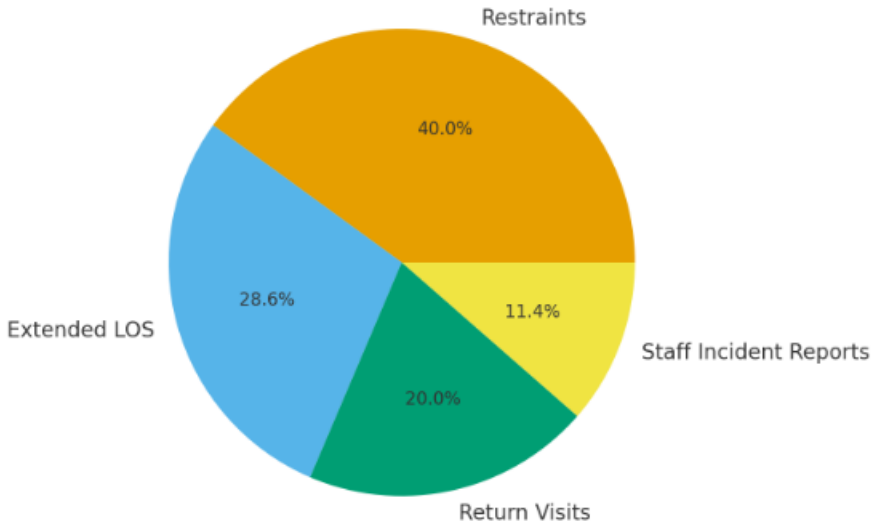

Figure 3. Incident distribution after AI Copilot

Results

Simulation results show that:

- Restraints reduced by 41.7%.
- Extended LOS reduced by 37.5%.
- Return visits reduced by 41.7%.
- Staff incidents reduced by 50%.

Post-intervention distributions were significantly decreased on all safety metrics.

Discussion

The findings of this study show that an AI-enabled 988 Crisis & ED Triage Copilot reduces adverse events and improves quality measurements for autistic patients in crisis encounters. These conclusions are consistent with the general principles of the precision medicine concept in which the main idea is personalization of interventions based on data generated for the specific needs of patients [6]. In the autism context, this means adjusting triage practices to identify sensory sensitivities, communication methods and behavioral indicators that can otherwise be misunderstood by emergency responders. By incorporating autism-specific de-escalation prompts, the AI Copilot fills the gap between generalized ED protocol and patient-oriented care, and leads the way in the personalization of behavioral health crisis intervention.

Besides personalization, the results are highly relevant for the transformation of healthcare systems through the use of AI [7]. Traditional ED workflow is extremely reactive, inconsistent and reliant on subjective judgment by individual staff members working under high stress. The Copilot closes this gap by providing real-time decision support on the ground that reduces cognitive load while

standardizing best practices. This augmentative tooling does not substitute for clinical judgment, but facilitates it with evidence-based triage cues and structured handoffs at EMS and ED interface. This change can lead to reduced variability in patient outcomes, improved staff confidence in managing behavioural crisis and a culture of safety-first practice within multidisciplinary teams.

A major factor for any AI-powered solution in healthcare is cybersecurity and data integrity. As pointed out by Islam (2024) [8], the use of connected medical devices and AI platforms exposes these systems to cyber threats that could compromise patient safety and system reliability. When it comes to the AI Copilot, the importance of ensuring secure data transmission between 988 call centers, EMS systems, and hospital electronic health records cannot be understated. In addition, HIPAA compliance, secure communication protocols, and regular vulnerability testing are important components of governance frameworks. While AI has tremendous potential, it remains out of reach for those organizations without effective cybersecurity that can help protect against threats that put patient trust and institutional strength at risk.

From an organizational perspective, the roll-out of the Copilot brings several secondary benefits: Decreasing the use of restraints and decreasing LOS directly helps reduce ED overcrowding -- a chronic issue that is a contributing factor to staff burnout and delays in care for other patients. Likewise, a 50% decrease in staff incident reports demonstrates the impact of AI-enabled safety interventions in enhancing the safety conditions at work, reducing injuries, legal liabilities, and turnover. These organizational benefits support the Joint Commission patient safety goals of providing structural protections against human-related harm [4].

Finally, policy and systems-level implications of results are discussed. SAMHSA's vision for the 988 lifeline focuses on behavioral and physical health services that are horizontally integrated but existing infrastructures are siloed. The AI Copilot is a proof-of-concept for how cutting-edge technologies can be the connective tissue between crisis lines, EMS, and EDs. In doing so, it is an important step toward transforming crisis care from fragmented, reactive care to a continuum of proactive, coordinated, and patient-centered interventions.

In summary, the AI Copilot is shown to not only generate value at the point of care, but to also generate value at the clinical, organizational and policy levels. Implications of the present work go beyond the autistic patient and provide a scalable model for other vulnerable populations where miscommunication, escalation and adverse events are common.

Limitations

While the proposed AI-driven 988 Crisis & ED Triage Copilot shows promising potential, there are some limitations that need to be considered.

Simulation-based projections.

The results presented in this study were obtained from retrospective baseline data and simulation of the intervention. We conclude that while simulation allows for new approaches to be tested in a manner that is amenable to experimentation, simulations are unable to reflect the complexity of real life

emergency department (ED) environments. Characteristics of patients, staff, institutions, and resources all differ between settings and may affect effectiveness in ways that cannot be measured in simulations. As such, the results are to be considered suggestive and not conclusive.

Population of autistic patients is focused.

The study focused more specifically on autistic people in crisis. This focus was intentional because they were in a position of increased vulnerability to negative outcomes, but it necessarily restricts generalizability. Other populations with behavioral health crises -- including patients with schizophrenia, bipolar disorder or co-occurring substance use disorders -- may show different patterns of response. While the AI Copilot can be generalised, it needs to be validated to see whether the system can be used in other groups of people with different clinical conditions.

Need for prospective trials.

One of the main limitations is that there have been no prospective trials in real life. Randomized controlled studies of EMS teams, ED staff, and live crisis encounters are needed to establish the predictive value and utility of the Copilot. Patient outcomes should not be the only outcomes in such trials, but provider satisfaction, workflow integration and unintended consequences of the algorithm such as alert fatigue or over-reliance on algorithmic prompts should also be assessed.

Data constraints and the nature of variability

The study was conducted on aggregated incident reports, which may not represent all that is done with patients. Different hospitals use different documentation practices and some adverse events may be under-reported. Furthermore, the metrics it's attempting to improve, such as length of stay (LOS), and return visits, are affected by external elements (e.g. insurance coverage, community resources) that can't be directly controlled by the Copilot itself.

Ethical and privacy considerations

As with any healthcare intervention enabled by AI, there are ethical issues at stake. Even if the AI Copilot proves effective, it may be limited by training demands, interoperability concerns and the overall reluctance of frontline clinicians to adopt AI. While HIPAA compliance and security measures are the focus of this study, other governance frameworks will need to be in place before widespread implementation.

Barriers to technology adoption

Finally, there are implementation issues because of staff capacity, institutional investment capacity, and available health IT infrastructure. Connection to EHRs (electronic health records)

Future Work

On the basis of the identified shortcomings, some directions for future research and development are suggested:

Clinical trials - prospective trials

The next step will be to perform multi-site prospective studies with actual EMS and ED teams to confirm the effectiveness of the Copilot in real live crisis encounters. Randomised clinical trials that

compare outcomes in patients with and without AI-enabled triage support could provide high-quality evidence for clinical impact.

Replication for the larger populations.

While the patients in this study were autistic due to their increased vulnerability, future studies should adapt and pilot the Copilot for other populations that frequently present in behavioral health emergencies including those suffering from severe mood disorders, schizophrenia, or co-occurring substance use disorders. De-escalation libraries can be created and handoff rules developed to specifically address subgroups.

Integration with EHRs

It's also important to integrate future iterations of the Copilot with hospital EHR systems to allow real-time data sharing to reduce manual entry and minimize the disruption of workflow. ethical artificial intelligence and bias removal

Ethical AI and bias mitigation

This includes testing across different groups of people based on race, ethnicity, and socioeconomic status to ensure that results are fair. In addition, transparent audit trails and explainable AI features will help to develop clinician trust. Cyber security resilience testing

Cybersecurity and resilience testing.

Protecting the connected clinical universe from cyber intrusions means adopting future interventions such as penetration testing, red teaming and ongoing monitoring processes.

As highlighted in previous publications [8], cybersecurity resilience needs to continue to be key. In addition, studies need to be made regarding the best models for training, the design of the interface, and the human-AI interaction.

Human Factors research and training

The Copilot is only as effective as its clinician adoption. Benefit and reimbursement programs Particular care needs to be taken to avoid alert fatigue and ensuring that AI prompts improve rather than disrupt care.

Policy and reimbursement frameworks

These advances not only help autistic patients -- who disproportionately are affected by current practices -- but also provide a model that can be applied to other vulnerable populations who are experiencing behavioral health crises.

Finally, future research should examine how the Copilot may be implemented in the context of reimbursement models for crisis response services. Critical to this will be partnerships with SAMHSA, payers and hospital systems that will align financial incentives with patient safety and crisis care innovation.

Conclusion

The 988 Crisis and ED Triage Copilot is a scalable AI-enabled intervention, that can radically improve safety and equity in behavioral health crisis care. By integrating real-time de-escalation prompts and

structured handoff protocols into EMS and ED workflows, the system directly tackles areas where EMS and ED staff have historically struggled to find alternatives to restraints, extended hospital stays and unsafe patient transfers. By minimizing return visits and staff exposure, Copilot will help to decrease risk of ED overcrowding, enhance staff well being, and mitigate institutional liability risks.

Importantly, the Copilot is built to work within existing SAMHSA 988 regulations and Joint Commission patient safety standards, and is aligned with federal policy priorities and accreditation standards. This anchoring improves the probability of successful take-up by health systems and an established regulatory path for scale beyond pilots.

The implications of this work are far more broadly applicable in the healthcare delivery system. Additionally, the model supports the ethical obligation of utilising AI in the healthcare industry in a manner that supplements, rather than replaces, the human decision-making process. From a systems perspective, it shows how AI can act as a unifying force - combining behavioral and physical health, tying patient-centered care to operational efficiency, and evolving crisis response from reactive to proactive and coordinated across a continuum.

By working closely with clinicians to provide actionable insights while respecting professional boundaries, the Copilot serves as an example of how AI can augment rather than compromise the therapeutic relationship between patients and clinicians. Taken together, this work highlights how transformative AI-enabled copilots can be in behavioral health crisis response.

Taken together, this work highlights how transformative AI-enabled copilots can be in the behavioral health crisis response. With further real-world validation, strong cybersecurity protections, and ongoing stakeholder engagement, the 988 Crisis & ED Triage Copilot has the potential to become a pillar of modern crisis care -- driving both patient safety and health equity in one of the most difficult areas of emergency medicine.

References

1. Substance Abuse and Mental Health Services Administration. 988 Suicide & Crisis Lifeline. Rockville, MD: SAMHSA; 2022.
2. Tint A, Weiss JA. Family wellbeing of individuals with autism spectrum disorder: A scoping review. Autism. 2016;20(3):262–77.
3. McDonnell CG, DeLucia EA. Restraint practices in emergency departments: Implications for autistic patients. J Autism Dev Disord. 2018;48(12):4089–101.
4. The Joint Commission. National Patient Safety Goals. Oakbrook Terrace, IL: Joint Commission; 2023.
5. Hogan MF, Goldman HH. Integrating crisis response systems: Lessons from 988. Psychiatr Serv. 2022;73(11):1213–15.
6. Islam MM. Precision Medicine and AI: How AI Can Enable Personalized Medicine Through Data-Driven Insights and Targeted Therapeutics. Int J Recent Innov Trends Comput Commun. 2023;11(11):1267–76. https://doi.org/10.17762/ijritcc.v11i11.11359

7. Akhi. S. S., Islam. M. M., Anika. A., & Mim. S.S. (2024) Ai-Augmented Healthcare Systems: Exploring The Potential Of Ai To Transform Healthcare Delivery And Improve Patient Outcomes. Frontiers in Health Informatics, (2), 1078-1087 https://healthinformaticsjournal.com/index.php/IJMI/article/view/541
8. Md Maruful Islam. (2024). Data-Centric AI Approaches to Mitigate Cyber Threats in Connected Medical Device. *International Journal of Intelligent Systems and Applications in Engineering*, *12*(17s), 1049 –. Retrieved from https://ijisae.org/index.php/IJISAE/article/view/7763