

Contents

| | | |
|----------|--|----------|
| 1 | Measuring the Invisible Work of Epic In-Basket Messaging in Outpatient Psychiatry | 2 |
| 1.1 | Executive Summary | 2 |
| 1.2 | 1. Problem Statement and Significance | 2 |
| 1.2.1 | 1.1 The Invisible Work Problem | 2 |
| 1.2.2 | 1.2 Human Factors Implications | 3 |
| 1.2.3 | 1.3 Specialty-Specific Inequity: The Psychiatry Disadvantage | 3 |
| 1.2.4 | 1.4 Healthcare System Impact | 3 |
| 1.3 | 2. Literature Review and Theoretical Framework | 4 |
| 1.3.1 | 2.1 Electronic Health Record Burden | 4 |
| 1.3.2 | 2.2 Usability and Design Issues | 4 |
| 1.3.3 | 2.3 Psychiatry-Specific Challenges | 4 |
| 1.3.4 | 2.4 Human Factors Theoretical Framework | 4 |
| 1.4 | 3. Research Objectives and Methods | 5 |
| 1.4.1 | 3.1 Primary Objectives | 5 |
| 1.4.2 | 3.2 Data Collection Methods | 5 |
| 1.4.3 | 3.3 Analytical Approach | 5 |
| 1.5 | 4. Key Findings and Results | 6 |
| 1.5.1 | 4.1 Invisible Work Equivalences and Extrapolations | 6 |
| 1.5.2 | 4.2 System-Wide Workload Overview | 6 |
| 1.5.3 | 4.3 Extreme Provider Disparities | 7 |
| 1.5.4 | 4.4 Provider Type Analysis | 7 |
| 1.5.5 | 4.5 Temporal Patterns | 8 |
| 1.5.6 | 4.6 Risk Assessment | 8 |
| 1.5.7 | 4.7 Proposed Productivity Metrics: The Penalty System | 9 |
| 1.6 | 5. Human Factors Analysis | 9 |
| 1.6.1 | 5.1 Cognitive Load Assessment | 9 |
| 1.6.2 | 5.2 Workload Misalignment | 10 |
| 1.6.3 | 5.3 Error Risk Factors | 10 |
| 1.6.4 | 5.4 System Design Implications | 10 |
| 1.7 | 6. Implications for Healthcare Informatics | 11 |
| 1.7.1 | 6.1 Electronic Health Record Design | 11 |
| 1.7.2 | 6.2 Provider Capacity Management | 11 |
| 1.7.3 | 6.3 Quality and Safety | 12 |
| 1.8 | 7. Recommendations and Solutions | 12 |
| 1.8.1 | 7.1 Immediate Interventions | 12 |
| 1.8.2 | 7.2 System-Level Improvements | 13 |
| 1.8.3 | 7.3 Long-Term Strategic Solutions | 13 |
| 1.8.4 | 7.4 Implementation Framework | 13 |
| 1.9 | 8. Limitations and Future Research | 14 |
| 1.9.1 | 8.1 Study Limitations | 14 |
| 1.9.2 | 8.2 Future Research Directions | 14 |
| 1.10 | 9. Conclusion | 14 |
| 1.10.1 | 9.1 Summary of Key Findings | 14 |
| 1.10.2 | 9.2 Human Factors Implications | 15 |
| 1.10.3 | 9.3 Strategic Recommendations | 16 |

| | | |
|--------|---|----|
| 1.10.4 | 9.4 Call to Action | 17 |
| 1.10.5 | 9.5 Final Thoughts | 18 |
| 1.11 | References | 19 |
| 1.12 | Figures and Tables | 21 |
| 1.12.1 | Figure 1: System-Wide Workload Overview | 21 |
| 1.12.2 | Figure 2: Extreme Provider Disparities | 21 |
| 1.12.3 | Figure 3: Provider Type Comparison | 21 |
| 1.12.4 | Figure 4: Temporal Patterns Analysis | 21 |
| 1.12.5 | Table 1: Raw vs. Normalized Workload Statistics | 21 |
| 1.12.6 | Table 2: Risk Assessment Results | 22 |

1 Measuring the Invisible Work of Epic In-Basket Messaging in Outpatient Psychiatry

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1.1 Executive Summary

This project addresses a critical informatics challenge in healthcare: the significant “invisible work” undertaken by outpatient psychiatry providers through Epic in-basket messaging. These tasks, which require clinical expertise and considerable time, are not reflected in traditional productivity metrics such as RVUs or visit counts. This disconnect between what is measured and the actual work performed creates a serious human factors issue, contributing to provider burnout, cognitive overload, and potential patient safety concerns.

To comprehensively understand this issue, the study systematically analyzes de-identified Epic messaging data over a one-year period, examining the volume, time burden, and distribution of in-basket work among outpatient psychiatry providers. The analysis explores patterns of workload distribution, identifies disparities among providers, and highlights the limitations of current measurement and compensation models. The findings underscore the need for more human-centered and equitable approaches to recognizing, measuring, and managing provider workload in outpatient psychiatry.

1.2 1. Problem Statement and Significance

1.2.1 1.1 The Invisible Work Problem

Outpatient psychiatry providers manage substantial “invisible work” through Epic in-basket messaging, including:

- Patient portal messages (medical advice requests)
- Patient call messages (handled through Epic system)
- Laboratory and imaging results review
- Prescription refills and authorizations

- Inter-provider communication and chart cosignatures
- Unviewed results and other in-basket tasks

Note: Traditional phone calls and paperwork handled outside the Epic system are not included in this analysis.

These tasks require clinical judgment, decision-making, and significant time investment, yet they remain completely absent from traditional productivity metrics such as Relative Value Units (RVUs) and visit counts. This creates a fundamental misalignment between measured productivity and actual provider effort.

1.2.2 1.2 Human Factors Implications

From a human factors perspective, this invisible work represents several critical issues:

Cognitive Load: Providers must constantly switch between patient-facing care and in-basket tasks, creating cognitive fragmentation and increased mental workload.

Workload Misalignment: Traditional metrics fail to capture the true burden of care delivery, leading to unrealistic expectations and unsustainable work practices.

Error Risk: The constant interruption and multitasking required for in-basket management increases the risk of missed information and clinical errors.

Burnout Factors: The disconnect between recognized work and actual effort contributes to provider dissatisfaction and burnout.

1.2.3 1.3 Specialty-Specific Inequity: The Psychiatry Disadvantage

A critical aspect of the invisible work problem is the stark inequity between psychiatry and other medical specialties in how in-basket work is managed and compensated:

Other Medical Specialties: Typically have dedicated support staff managing patient communications - Physician Assistants (PAs) or nurses handle phone calls and routine EHR messages - Patients requesting physician consultation are directed to schedule billable appointments - In-basket management is supported by clinical staff, not physicians - Clear boundaries between billable and non-billable work

Psychiatry at Penn Medicine: Expected to manage all patient communications independently - No dedicated support staff for in-basket management - Physicians handle all patient calls, messages, and requests personally - No billing mechanism for patient communication and consultation - Uncompensated work that would be billable in other specialties - Single-provider responsibility for all aspects of patient care

The Inequity: Psychiatry providers perform the equivalent of 1.01 FTE of uncompensated work that other specialties delegate to support staff or bill as appointments, creating a fundamental unfairness in workload expectations and compensation models.

1.2.4 1.4 Healthcare System Impact

The invisible work problem has broader implications for healthcare system design and management:

- **Capacity Planning:** Current methods underestimate true provider workload, leading to overbooking and unsustainable schedules

- **Quality Metrics:** Patient safety and care quality may be compromised by unrecognized workload burdens
 - **Provider Retention:** Unrecognized work contributes to provider dissatisfaction and turnover
 - **System Efficiency:** Invisible work represents untracked resource utilization that affects overall system performance
-

1.3 2. Literature Review and Theoretical Framework

1.3.1 2.1 Electronic Health Record Burden

A substantial and growing body of research has drawn attention to the hidden cognitive demands imposed by in-basket workload and its contribution to provider burnout. Studies have documented that the volume and frequency of inbox notifications can be overwhelming, with some physicians receiving more than 70 notifications per day. This deluge of information creates a high risk of missed messages and cognitive overload, as described by Murphy et al. (2016). Further, audit log analyses have revealed that physicians spend nearly half of their workday engaged in EHR-related tasks, including so-called “desktop medicine” such as responding to messages—time that often rivals or exceeds the hours spent in direct patient care (Tai-Seale et al., 2017). The correlation between heavy messaging workloads and increased EHR time is well established, with higher levels of multitasking and a greater risk of burnout observed among those with the heaviest messaging burdens (Tai-Seale et al., 2019; Shanafelt et al., 2016).

1.3.2 2.2 Usability and Design Issues

The design and usability of in-basket interfaces have also come under scrutiny. Many studies have found that these interfaces are poorly designed, with features that increase memory burden and delay the prioritization of important messages (Murphy et al., 2019). The need to constantly switch between tasks and maintain clinical context across multiple messages places a significant cognitive demand on providers. When the design is suboptimal and message volumes are high, the risk of missing critical information or delaying responses is further amplified, increasing the potential for clinical errors.

1.3.3 2.3 Psychiatry-Specific Challenges

Psychiatry faces unique challenges in the context of in-basket messaging. The COVID-19 pandemic, for example, has led to a dramatic increase in portal messaging volume within psychiatry practices, with message rates rising sixfold per patient according to Bernstein et al. (2023). The nature of psychiatric care itself often involves complex medication management, coordination of therapy, and crisis intervention, all of which may be conducted through messaging systems. Moreover, the patient population served by psychiatry tends to have higher rates of portal usage and messaging needs compared to other specialties, further compounding the workload.

1.3.4 2.4 Human Factors Theoretical Framework

To better understand the invisible work problem, this study draws on several key human factors principles. Workload theory is used to examine how the cognitive and temporal demands of in-basket management can exceed provider capacity, leading to overload and inefficiency. Error theory provides a lens for analyzing how system design and workflow contribute to the potential for mistakes.

Usability principles are applied to evaluate how the design of interfaces affects task performance and provider experience. Finally, systems thinking is employed to consider how invisible work impacts the performance and sustainability of the healthcare system as a whole.

1.4 3. Research Objectives and Methods

1.4.1 3.1 Primary Objectives

The primary objectives of this research are multifaceted. First, the study seeks to quantify the total volume and time burden associated with Epic in-basket messaging for providers in Department 603 (PBH OPC 3535 Market Street, 2nd floor). Second, it aims to analyze patterns of variation across different message types, individual providers, and scheduled hours, in order to better understand how workload is distributed. Third, the research will assess the temporal distribution of in-basket work, exploring how tasks are managed during business hours versus after hours and on weekends. Fourth, the findings will be interpreted through human factors frameworks to elucidate the implications for workload, cognitive demands, and error risk. Finally, the study will propose strategies to make invisible work more visible in departmental reporting and capacity planning, with the goal of informing more equitable and sustainable practices.

1.4.2 3.2 Data Collection Methods

To achieve these objectives, the study utilizes aggregated, de-identified Epic messaging data spanning from July 2024 to June 2025. The provider population includes 64 individuals with roles such as Attending Psychiatrists, Psychiatric Nurse Practitioners, and Psychiatry Residents. However, the analysis focuses on the 56 providers who had at least 30 days in the system, ensuring that only those with adequate observation periods are included.

The data collected encompasses a range of elements: monthly counts of in-basket messages by type for each provider, aggregated time spent on in-basket messages, scheduled hours per provider per month, the timing of message handling (distinguishing between business hours, after-hours, weekdays, and weekends), and the turnaround time for message closure. To protect privacy, all data is de-identified, with providers coded anonymously to allow for workload comparisons without risking individual identification.

1.4.3 3.3 Analytical Approach

The analytical approach is comprehensive and multi-layered. Descriptive analysis is used to summarize totals, trends, and distributions across all relevant metrics, providing a broad overview of the invisible work landscape. Comparative analysis enables the examination of differences in workload across message types, providers, and scheduled hours, highlighting areas of disparity or concern. To ensure fair comparisons, workload metrics are normalized per observation period (i.e., days in the system). Visualization techniques, such as time series and distribution plots, are employed to make patterns and trends more accessible and interpretable. Throughout, human factors frameworks are applied to interpret the findings and draw out their implications for provider workload, cognitive demands, and the risk of error.

1.5 4. Key Findings and Results

1.5.1 4.1 Invisible Work Equivalences and Extrapolations

The study’s analysis revealed that providers collectively spent 1,925 hours on invisible work over the course of a year—a figure with far-reaching implications for healthcare system capacity and resource allocation. To put this in perspective, this amount of work is equivalent to the annual workload of 1.01 full-time providers, assuming a standard of 1,920 clinical hours per FTE. In practical terms, absorbing this invisible workload would require hiring an additional full-time provider, at an estimated cost of \$200,000 to \$300,000 per year. Thus, the invisible work performed by psychiatry providers represents between \$202,000 and \$303,000 in uncompensated provider time.

The impact on clinical capacity is equally striking. The 1,925.4 hours of invisible work could have supported 3,851 additional patient visits if each appointment lasted 30 minutes, or as many as 5,776 visits if appointments were 20 minutes each. At a rate of \$150 per visit, this translates to a lost revenue opportunity of \$577,625. In terms of patient access, these hours could have enabled care for 324 additional patients annually, assuming each patient is seen 12 times per year.

Work-life balance is also significantly affected. Of the total invisible work, 774 hours—or 40.2%—were performed outside the standard business hours of 7 AM to 7 PM. This after-hours burden is equivalent to 97 additional eight-hour workdays, or nearly 20 weeks of extra evening and night work. While minimal weekend work was detected in the available Sunday data (0.5 hours total), the absence of Saturday data suggests that the true weekend burden may be even higher.

When these patterns are extrapolated across the health system, the scale of the issue becomes even more apparent. For 100 providers, invisible work would total 3,466 hours annually, requiring two additional FTEs and representing over \$1 million in potential revenue. For 500 or 1,000 providers, the numbers scale proportionally, with up to 18 FTEs and over \$10 million in revenue at stake.

The potential for efficiency gains is also notable. A 10% improvement in efficiency could free up 193 hours (0.10 FTE), while a 25% or 50% improvement could yield 481 and 963 hours, respectively—translating into substantial additional revenue and provider capacity.

The analysis also uncovered significant disparities among providers. The difference between the highest and lowest burdened providers was a staggering 27.5-fold. The provider with the highest normalized workload logged 173.4 hours per year (0.09 FTE), while the lowest logged just 6.3 hours (0.003 FTE). If all providers performed at the median level of 45.7 hours per year, the system could save 479 hours annually—equivalent to 0.25 FTE. Redistributing workload to reduce these disparities could free up significant capacity and improve provider satisfaction. These disparities are illustrated in **Figure 2**.

These equivalences and extrapolations provide concrete metrics for strategic decision-making. For example, every \$200,000 to \$300,000 invested in efficiency improvements could free up the capacity of one full-time provider. Calculating return on investment (ROI) for such improvements becomes straightforward, and the data can inform decisions about scaling, resource allocation, and work-life balance targets. For instance, reducing after-hours work by 50% would eliminate 387 hours, or 48 additional eight-hour workdays of evening and night work.

1.5.2 4.2 System-Wide Workload Overview

A system-wide analysis revealed that invisible work is a substantial and pervasive issue across the provider population. Over 12 months, 56 providers with at least 30 days of observation collectively

spent 1,925.4 hours on in-basket messaging—equivalent to more than 80 days of continuous work. On average, this amounts to 34.4 hours per provider annually (raw), or 54.3 hours per provider when normalized for observation period. These findings are detailed in **Figure 1**.

The volume of messages handled was extensive and spanned multiple categories, including patient portal and call messages, laboratory and imaging results, prescription management, and inter-provider communication. The distribution of work was not confined to business hours; 40.2% of the total workload (774 hours) occurred after hours, and while weekend work appeared minimal in the available data, the lack of Saturday data suggests the true burden may be underestimated. These findings underscore the significant impact of invisible work on work-life balance and highlight the need for better coverage systems.

1.5.3 4.3 Extreme Provider Disparities

Perhaps the most striking finding was the extreme variation in workload distribution among providers. The coefficient of variation for normalized workload was 68.7%, indicating a highly inconsistent distribution that far exceeds what is typically seen in healthcare settings. Some providers experienced minimal messaging burden, while others faced overwhelming volumes—resulting in a 27.5-fold difference between the highest and lowest burdened individuals.

A small subset of providers (7 out of 64, or 10.9%) handled one-third of all messaging, creating unsustainable work conditions for those with the highest burdens. The analysis also found that 8 providers (12.5%) were excluded due to having less than 30 days in the system; these individuals contributed only 0.8% of the total workload, ensuring that the analysis accurately reflects providers with adequate observation periods.

The extreme provider disparities are displayed in **Figure 2**, showing the distribution of normalized workload across all providers and highlighting the 27.5-fold difference between highest and lowest burden providers.

The key statistics comparing raw vs. normalized workload metrics are summarized in **Table 1**, demonstrating the effectiveness of observation period normalization.

1.5.4 4.4 Provider Type Analysis

When examining workload by provider type, significant differences emerged. Attending Psychiatrists bore the highest average workload and after-hours burden, often managing the most complex cases and facing the greatest risk for burnout and clinical error due to cognitive overload. These providers are in greatest need of workload redistribution and support systems, with an average normalized workload of 64.0 hours per year—well above the system median.

Nurse Practitioners demonstrated the highest workload burden, with an average normalized workload of 121.3 hours per year—nearly double that of attending psychiatrists. This suggests they may be handling more complex cases, have different support structures, or face unique workload challenges that require immediate attention and support.

Psychiatry Residents/Fellows exhibited the lowest workload burden, with an average normalized workload of 43.4 hours per year. This lower burden reflects their structured training environment, supervision requirements, and the learning curve associated with message management efficiency.

Key insights from this analysis include the significant correlation between provider type and workload burden ($p < 0.001$), the inverse relationship between experience level and after-hours work, and

the critical importance of supervision, support systems, and collaborative care models in reducing individual provider burden.

The workload patterns across provider types are compared in **Figure 3**, showing the significant differences between Attending Psychiatrists, Nurse Practitioners, and Psychiatry Residents/Fellows.

1.5.5 4.5 Temporal Patterns

Temporal analysis revealed that the invisible work burden was consistent throughout the year, with minimal seasonal variation (coefficient of variation: 15.2%). There were no significant relief periods or cycles in workload, and the average monthly workload was 160.5 hours across all providers. The busiest months were November and March, while July and December saw the lowest workloads.

Daily patterns showed that the majority of messaging occurred during business hours (9 AM to 5 PM), accounting for nearly 60% of the total workload. However, a significant portion—40.2%—continued after hours, with notable peaks in the evening (7 PM to 10 PM) and early morning (6 AM to 7 AM). Weekend work, as measured by Sunday data, was minimal, but the absence of Saturday data means the true weekend burden is likely underestimated. These patterns highlight the ongoing challenges to work-life balance and the need for comprehensive coverage and support systems.

Further analysis indicated that workload distribution remained relatively stable over time, with no evidence of cyclical relief or significant increases. After-hours work patterns were consistent throughout the observation period, underscoring the persistent nature of the invisible work burden.

The temporal patterns of invisible work are shown in **Figure 4**, including monthly trends, daily patterns, and after-hours distribution throughout the observation period.

The risk assessment results are presented in **Table 2**, categorizing providers into high-risk, moderate-risk, and low-risk categories based on workload burden and after-hours work patterns.

1.5.6 4.6 Risk Assessment

The study identified a subset of providers at high risk due to excessive workload and after-hours burden. Specifically, 7 providers (12.5%) were classified as high-risk, each with a normalized workload exceeding 100 hours per year and more than half of their work occurring after hours. These individuals exhibited poor work-life balance, unsustainable work patterns, and a high potential for error due to cognitive overload and fatigue, necessitating immediate intervention to prevent burnout and ensure patient safety. The complete risk assessment results are presented in **Table 2**.

An additional 15 providers (26.8%) were identified as moderate-risk, with above-average workloads and moderate after-hours burdens. While their work-life balance was less compromised, they still required proactive monitoring and support to prevent escalation to high-risk status.

The majority of providers (34, or 60.7%) were classified as low-risk, with manageable workloads, good work-life balance, and efficient message management. These individuals serve as models for best practices and effective workload distribution.

The risk assessment methodology was multi-dimensional, incorporating workload volume, after-hours burden, and efficiency metrics, with statistical thresholds based on distribution analysis and outlier detection. Adjustments were made for provider type and experience level, and the assessment was designed to be dynamic, with regular monitoring and updates.

Even after normalizing for observation period, substantial disparities remained. The mean normalized workload was 54.3 hours per year (95% CI: 45.5-64.8), with a median of 45.7 hours and a standard deviation of 37.3 hours. The extreme ratio of 27.5x (compared to 5,044x in raw data) demonstrates the effectiveness of normalization, but also the persistence of high variability across providers. These statistics are detailed in **Table 1**.

To mitigate these risks, the study recommends immediate workload redistribution for high-risk providers, proactive monitoring and early intervention for those at moderate risk, the sharing of best practices and mentoring programs, the adoption of collaborative care models, and the implementation of technology-assisted solutions to improve efficiency.

1.5.7 4.7 Proposed Productivity Metrics: The Penalty System

In response to the challenges of invisible work, the department has proposed new productivity metrics that would penalize providers for delays in addressing inbox messages, regardless of the actual workload burden or the complexity of the cases involved. This approach, however, is fraught with problems. By penalizing providers for delays without considering the time and effort required, the system creates perverse incentives that prioritize speed over quality. It fails to account for the complexity of messages and the clinical decision-making required, pressuring providers to respond quickly rather than thoroughly. This not only disincentivizes careful clinical reasoning and comprehensive patient care but also punishes providers for work that is already uncompensated and invisible.

The impact on provider behavior is likely to be negative. Providers may feel compelled to rush their responses to avoid penalties, potentially compromising the quality of care. The added stress and cognitive load from time pressure can further erode work-life balance and increase the risk of errors. Ultimately, this system exacerbates the very problems it seeks to address.

At its core, the fundamental flaw of this penalty-based approach is that it seeks to enforce accountability for invisible work without providing the necessary support structures. Unlike other specialties, psychiatry providers do not have access to adequate support staff for in-basket management, nor are there billing mechanisms in place for patient communication. The system fails to consider the clinical complexity of psychiatric care and the time required for proper decision-making, and it does not recognize the inequity compared to other medical specialties.

A more effective and equitable approach would be to provide support staff for in-basket management, implement billing mechanisms for patient communication, and focus on quality metrics rather than speed metrics. It is essential to recognize the unique challenges of psychiatric care and to address the fundamental inequity in workload expectations. Only by making invisible work visible and valued can the department hope to create a sustainable and fair system for both providers and patients.

1.6 5. Human Factors Analysis

1.6.1 5.1 Cognitive Load Assessment

The demands placed on providers by Epic in-basket messaging are substantial from a cognitive perspective. Providers are required to constantly shift their attention between direct patient care and the management of electronic messages. This frequent multitasking fragments their cognitive processes, making it difficult to maintain focus on any single task and increasing the overall mental

workload. As message volumes rise, providers must also retain and recall clinical context across numerous patient interactions, which places a significant burden on memory. This situation heightens the risk of information overload, where critical details may be missed, and the potential for errors increases. Furthermore, the necessity for continuous clinical decision-making within the messaging environment leads to decision fatigue. As providers make more decisions throughout the day, the quality of those decisions can decline, further elevating the risk of mistakes and contributing to professional burnout.

1.6.2 5.2 Workload Misalignment

A major challenge in the current system is the misalignment between actual provider workload and the metrics used to measure productivity. Traditional measures, such as Relative Value Units (RVUs) and visit counts, fail to account for the time and effort spent on messaging work. This omission creates unrealistic expectations for provider output, often resulting in overbooked schedules and increased dissatisfaction among providers who feel their true workload is unrecognized. Because capacity planning relies on these incomplete metrics, schedules become unsustainable, which not only increases the risk of burnout but also compromises patient safety. Additionally, the invisible work of messaging represents a significant use of resources that goes untracked, affecting system efficiency, distorting quality metrics, and undermining accurate performance measurement.

1.6.3 5.3 Error Risk Factors

The risk of error is exacerbated by several factors inherent in the current messaging environment. Providers face constant interruptions from incoming messages, which disrupt workflow and reduce the quality of task completion. These interruptions increase the likelihood of errors and create additional safety risks for patients. High message volumes contribute to information overload, making it more likely that critical information will be missed or that responses to urgent matters will be delayed, potentially resulting in patient harm. The pressure to manage messages after hours or on weekends further compounds these risks, as fatigue can lead to diminished decision quality and a greater chance of safety incidents.

1.6.4 5.4 System Design Implications

The design of current in-basket interfaces often fails to adequately support provider needs, thereby increasing cognitive burden. Many systems lack intelligent features for prioritizing messages or stratifying risk, and information is frequently poorly organized, making it difficult for providers to preserve clinical context. The absence of robust decision support systems and automated triage tools means that providers must manually sift through large volumes of information, further increasing cognitive load. Search and filtering capabilities are often inadequate, and mobile interfaces for after-hours access are poorly designed, limiting usability outside of standard work hours.

Workflow integration is another area of concern. Messaging systems are not seamlessly integrated with clinical workflows, resulting in additional steps, frequent workflow interruptions, and increased time spent on context switching. This lack of integration reduces overall efficiency and detracts from clinical focus. Furthermore, there is often poor linkage with scheduling, patient management systems, and clinical decision support tools, as well as inadequate documentation and tracking capabilities.

Support systems for providers are also limited. There are few mechanisms for redistributing workload or implementing automated load balancing, and backup systems and coverage models are often

insufficient. Collaborative approaches and team-based care are underutilized, and there is a lack of peer support, mentoring, and adequate training resources. Access to tools and best practices that could improve efficiency is similarly limited.

Finally, broader system architecture issues contribute to these challenges. Data is often presented in a fragmented manner, with poor information architecture that makes it difficult to gain a comprehensive view of workload. Real-time monitoring and alerting systems are lacking, and there are insufficient options for customization and personalization to meet individual provider needs. Integration with existing clinical systems and workflows is often suboptimal, scalability and performance optimization are limited, and security and privacy protections for sensitive communications may be inadequate. Collectively, these design shortcomings exacerbate the human factors challenges associated with invisible work in Epic in-basket messaging.

1.7 6. Implications for Healthcare Informatics

The findings of this study have significant implications for the field of healthcare informatics, particularly in the design and management of electronic health records (EHRs), provider capacity, and the overall quality and safety of patient care.

1.7.1 6.1 Electronic Health Record Design

A critical area for improvement lies in the design of EHR in-basket interfaces. Current systems often lack features that help providers efficiently prioritize and categorize messages, which contributes to increased cognitive load and reduced usability. To address these shortcomings, EHR interfaces should be redesigned to include advanced prioritization and categorization tools, making it easier for providers to manage their inboxes and focus on the most urgent or clinically relevant messages. Such improvements would not only streamline workflows but also help reduce the mental burden associated with message management.

Beyond interface enhancements, there is a pressing need for better integration of messaging systems with clinical workflows. Seamless task switching and the preservation of clinical context are essential for maintaining efficiency and minimizing disruptions. When messaging platforms are tightly integrated with other clinical tools, providers can move more fluidly between tasks, maintain focus, and avoid unnecessary repetition or information loss. This integration supports more efficient care delivery and helps ensure that important clinical details are not overlooked.

Additionally, the incorporation of robust clinical decision support within the messaging environment is vital. Automated tools that assist with prioritization, risk stratification, and quality improvement can help providers make better decisions more quickly, reducing the likelihood of errors and enhancing the overall quality of care.

1.7.2 6.2 Provider Capacity Management

Managing provider capacity effectively requires the development of realistic and comprehensive workload metrics. Traditional measures often fail to account for the time and effort spent on messaging, leading to an incomplete picture of provider burden. By including messaging work, normalizing for panel size, and considering after-hours activity, organizations can develop more accurate assessments of provider workload.

Accurate capacity planning is essential for creating sustainable schedules that prevent burnout and maintain high standards of care. When organizations understand the true scope of provider work, they can allocate resources more effectively, balance workloads, and develop support systems that enhance efficiency. This, in turn, leads to better provider well-being and improved patient outcomes.

1.7.3 6.3 Quality and Safety

The quality and safety of patient care are directly influenced by how invisible work is managed. Reducing provider error potential requires better workload management and strategies to minimize cognitive overload. By decreasing interruptions and workflow disruptions, providers can make higher-quality decisions, respond to messages more promptly, and maintain a higher level of clinical reasoning and diagnostic accuracy. These improvements can lead to fewer medication errors, better patient monitoring, and more reliable follow-up care.

Sustainable workloads and attention to provider well-being also enhance the quality of care delivered. When providers are less burdened, they can focus more fully on patient interactions, communicate more effectively, and adhere more closely to clinical guidelines. This results in higher patient satisfaction, better engagement, and improved health outcomes.

From a systems perspective, optimizing resource utilization leads to greater efficiency and productivity, reduced costs, and improved performance metrics. Enhanced provider retention, better patient access, and more reliable system performance are all achievable when invisible work is recognized and managed appropriately.

To support these goals, it is important to develop comprehensive quality metrics that capture invisible work. Integrating these metrics into quality assessment frameworks, implementing real-time monitoring of provider well-being and patient safety, and establishing continuous improvement processes will help organizations benchmark their performance and track long-term outcomes.

1.8 7. Recommendations and Solutions

Addressing the challenges identified in this study requires a multi-faceted approach, combining immediate interventions with long-term strategic changes.

1.8.1 7.1 Immediate Interventions

In the short term, it is essential to provide immediate support to providers who are at high risk of overload. This can be achieved through the redistribution of workload, the addition of support staff, and, where necessary, temporary reductions in capacity. Continuous monitoring of provider burden is also crucial. Implementing real-time workload tracking and alert systems can help organizations identify when providers are approaching unsafe levels of work, allowing for timely interventions. Improving after-hours management through shared coverage models, clear protocols for urgent messages, and robust weekend support systems can further alleviate provider burden and reduce the risk of burnout.

Addressing Specialty Inequity: Immediate steps to address the psychiatry disadvantage - **Support Staff Provision:** Hire dedicated PAs or nurses for in-basket management (as other specialties have) - **Billing Mechanisms:** Implement billing codes for patient communication and consultation - **Workload Recognition:** Acknowledge the inequity and provide appropriate

compensation - **Resource Allocation:** Ensure psychiatry receives equivalent support to other medical specialties - **Policy Revision:** Revise productivity metrics to account for specialty-specific workload differences

1.8.2 7.2 System-Level Improvements

At the system level, a comprehensive redesign of EHR in-basket functionality is needed. This includes the development of intelligent message prioritization and categorization features, context-aware decision support systems, and streamlined workflow integration. Improving the information architecture of these systems can significantly reduce cognitive load and enhance usability.

Implementing comprehensive workload management systems is another key strategy. Real-time monitoring of provider burden, automated algorithms for redistributing work, and collaborative care models for managing messages can all contribute to a more balanced and sustainable work environment. Performance dashboards for administrators can provide valuable insights into system functioning and highlight areas for improvement.

Quality improvement initiatives should focus on optimizing processes and redesigning workflows to minimize invisible work. Training programs that teach efficient message management, peer support and mentoring systems, and continuous feedback loops can all help providers adapt to new systems and maintain high standards of care.

1.8.3 7.3 Long-Term Strategic Solutions

Long-term solutions require changes at the policy, technology, and organizational culture levels. Advocacy for healthcare policy reform is necessary to ensure that messaging work is included in productivity metrics and that workload measurement is standardized across health systems. Regulatory requirements for workload transparency and the development of quality measures that account for invisible work will help drive systemic change.

Technological innovation will play a major role in the future of healthcare informatics. The development of artificial intelligence tools for message triage and response, natural language processing for automated documentation, predictive analytics for workload forecasting, and the integration of virtual assistants and chatbots can all help reduce provider burden and improve efficiency.

Finally, transforming organizational culture is essential for sustaining these changes. Shifting from volume-based to value-based care metrics, emphasizing provider well-being and sustainability, promoting collaborative and team-based care models, and ensuring recognition and compensation for invisible work will help create a more supportive and effective healthcare environment.

1.8.4 7.4 Implementation Framework

A phased approach is recommended for implementing these solutions. In the immediate term (0-6 months), organizations should focus on supporting high-risk providers, implementing basic workload monitoring, improving after-hours coverage, and providing education and training. In the short term (6-18 months), efforts should shift to EHR interface improvements, the development of workload redistribution systems, the implementation of quality improvement processes, and the enhancement of performance measurement. Over the long term (18-36 months), comprehensive system redesign, advanced technology integration, policy and regulatory advocacy, and organizational culture transformation should be pursued.

Success should be measured by reductions in provider burnout rates, improvements in work-life balance, decreases in after-hours workload, enhanced patient satisfaction and safety, and increased provider retention and satisfaction.

1.9 8. Limitations and Future Research

While this study provides valuable insights, several limitations must be acknowledged, and future research directions should be considered.

1.9.1 8.1 Study Limitations

The scope of the data analyzed was limited to Epic in-basket messaging, excluding other EHR-related tasks and documentation, as well as phone calls and paperwork conducted outside the system. The analysis was confined to the outpatient psychiatry department within a single health system, which may limit the generalizability of the findings. The observation period was restricted to 12 months, which may not capture seasonal variations or long-term trends, and limits the ability to assess causal relationships. Additionally, there is potential for unmeasured confounding factors that could influence the results. Measuring qualitative aspects such as cognitive load, mental workload, patient safety impact, provider satisfaction, burnout, and quality of care outcomes proved challenging, as these were not directly assessed in this study.

1.9.2 8.2 Future Research Directions

Future research should address these limitations through longitudinal studies that extend observation periods to assess trends over multiple years, evaluate the effectiveness of interventions, and examine seasonal and cyclical variations. Multi-site validation is also important, expanding the analysis to other health systems and specialties to validate findings across different EHR platforms and organizational contexts. Comparative studies can help identify how workload patterns differ across medical specialties and organizational cultures, and support the development of standardized measurement approaches.

Intervention research is needed to evaluate the effectiveness of specific solutions, such as randomized controlled trials of workload interventions, assessments of EHR interface improvements, evaluations of collaborative care models, and measurements of technology-assisted solutions. Finally, studies that focus on patient outcomes are essential to understand the impact of invisible work on care quality. This includes examining correlations between invisible work and patient safety, evaluating care quality and patient satisfaction, assessing clinical outcomes and error rates, and measuring the quality of patient-provider communication.

By addressing these research gaps, the field can develop a more comprehensive understanding of invisible work in healthcare and identify effective strategies for improvement.

1.10 9. Conclusion

1.10.1 9.1 Summary of Key Findings

This comprehensive analysis of Epic in-basket messaging in outpatient psychiatry reveals a critical healthcare informatics challenge: substantial invisible work that remains unrecognized in traditional

productivity metrics. The study demonstrates that 56 providers collectively perform 1,925.4 hours of invisible work annually, equivalent to 1.01 full-time providers, representing \$577,625 in lost revenue opportunity and significant work-life balance impacts.

The most striking finding is the extreme disparity in workload distribution, with a 27.5x difference between the highest and lowest burden providers. This inequity, combined with the 40.2% of work performed outside business hours, creates unsustainable conditions for high-burden providers and represents a serious human factors problem that threatens both provider well-being and patient safety.

1.10.2 9.2 Human Factors Implications

Examining the invisible work problem through a human factors lens reveals a complex web of interrelated challenges that profoundly affect both providers and the healthcare system as a whole. One of the most significant issues is cognitive overload. Providers are required to constantly shift their attention between direct patient care and the multitude of tasks generated by in-basket messaging. This relentless task-switching fragments their cognitive processes, making it difficult to maintain focus and increasing the likelihood of errors. The mental workload imposed by this environment is substantial, as providers must juggle clinical decision-making, documentation, and communication, often simultaneously and under time pressure.

Compounding this cognitive strain is a fundamental misalignment between actual workload and the metrics used to measure productivity. Traditional systems, such as Relative Value Units (RVUs) and visit counts, fail to account for the time and effort devoted to in-basket messaging and other forms of invisible work. As a result, providers are often held to unrealistic expectations that do not reflect the true scope of their responsibilities. This disconnect fosters unsustainable work practices, as providers strive to meet targets that ignore a significant portion of their daily effort, ultimately contributing to burnout and dissatisfaction.

The design of current EHR systems further exacerbates these challenges. Many interfaces and workflows are not tailored to the realities of clinical practice, instead introducing additional layers of complexity and inefficiency. Rather than streamlining tasks and supporting provider needs, these systems often increase cognitive burden, forcing users to navigate cumbersome menus, manage excessive notifications, and perform repetitive actions that detract from patient care. The lack of intuitive design and workflow integration means that technology, rather than serving as an aid, becomes another source of frustration and fatigue.

Finally, the issue of organizational justice emerges as a critical human factors concern. The data reveal stark disparities in how invisible work is distributed among providers, with some shouldering a disproportionate share of the burden. This inequity leads to working conditions that are not only unfair but also demoralizing, undermining both individual satisfaction and the overall sense of fairness within the organization. When invisible work is neither recognized nor equitably managed, it erodes trust in the system and diminishes the well-being of those most affected.

In sum, the invisible work problem is not merely a matter of unmeasured effort; it is a multifaceted human factors challenge that encompasses cognitive overload, misaligned workload measurement, flawed system design, and organizational injustice. Addressing these issues is essential for creating a more sustainable, equitable, and supportive environment for healthcare providers.

1.10.3 9.3 Strategic Recommendations

Successfully addressing the invisible work problem in outpatient psychiatry—and, by extension, in healthcare at large—demands a comprehensive, multi-layered strategy that unfolds across both immediate and long-term horizons. The challenge is not simply to patch over the most acute pain points, but to fundamentally reshape the systems, technologies, and cultures that have allowed invisible work to proliferate unchecked. The following recommendations are presented as a narrative roadmap, guiding organizations from urgent triage to lasting transformation.

Immediate Actions: Relieving the Pressure Valve

The first and most pressing priority is to provide tangible relief to those providers currently bearing the heaviest burdens. For these individuals, invisible work is not an abstract concept but a daily reality that threatens their well-being and, by extension, the quality of patient care. Organizations must act swiftly to identify high-burden providers—using available data and direct feedback—and implement measures that redistribute workload more equitably. This may involve temporarily reassigning certain tasks, bringing in additional support staff such as medical assistants or scribes, and ensuring that after-hours coverage is robust enough to prevent burnout. These interventions are not merely stopgaps; they are essential for stabilizing the workforce and preventing attrition while longer-term solutions are developed.

System Improvements: Making the Invisible Visible

Once the most acute needs are addressed, attention must turn to the systems and processes that shape daily work. At the heart of the invisible work problem lies the design of the EHR itself, which too often obscures effort and fragments provider attention. A comprehensive redesign of EHR interfaces is needed—one that prioritizes usability, reduces cognitive load, and streamlines the management of in-basket messages. In parallel, organizations should implement workload management systems that track not only visible metrics like appointments and RVUs, but also the time and effort spent on messaging, documentation, and other non-billable tasks. Quality improvement initiatives should be launched to continuously refine these systems, ensuring that invisible work is not only measured but actively managed. By making this work visible, organizations can begin to align expectations, resources, and recognition with the true scope of provider effort.

Strategic Transformation: Changing the Rules of the Game

While system improvements can yield significant benefits, lasting change requires a broader transformation of the policies, technologies, and cultures that define healthcare work. Advocacy at the policy and regulatory level is essential to ensure that invisible work is recognized and valued in compensation models, accreditation standards, and reporting requirements. Investment in technology innovation—such as artificial intelligence for message triage, predictive analytics for workload forecasting, and virtual assistants for routine tasks—can further reduce the burden on providers and free up time for direct patient care. Perhaps most importantly, organizations must embark on a deliberate effort to transform their cultures: shifting from a narrow focus on volume-based metrics to a more holistic appreciation of provider well-being, teamwork, and the full spectrum of clinical work. This cultural shift is the foundation upon which all other improvements rest.

Continuous Improvement: Sustaining Progress Over Time

Finally, it is vital to recognize that the work of addressing invisible work is never truly finished. Healthcare is a dynamic field, and new sources of invisible work will inevitably emerge as technologies and care models evolve. To guard against regression and ensure that progress is sustained, organiza-

tions must establish robust processes for ongoing monitoring, evaluation, and improvement. This includes regular review of workload data, provider feedback, and patient outcomes, as well as the flexibility to adapt interventions as circumstances change. By embedding continuous improvement into the fabric of organizational life, healthcare systems can remain vigilant against the re-emergence of unsustainable practices and ensure that the gains achieved are not lost over time.

In summary, the path forward is neither simple nor linear. It requires immediate action to relieve those most affected, systemic improvements to make invisible work visible and manageable, strategic transformation to change the underlying rules and culture, and a commitment to continuous improvement. Only by weaving together these threads can healthcare organizations hope to create a more just, sustainable, and human-centered environment for both providers and patients.

1.10.4 9.4 Call to Action

The challenge of invisible work in healthcare is not a distant or abstract concern—it is a pressing, lived reality that shapes the daily experiences of providers, the effectiveness of organizations, and the very fabric of patient care. This problem, so often hidden beneath the surface of productivity metrics and institutional dashboards, is in fact a foundational threat to the sustainability, quality, and humanity of our healthcare system. It is a challenge that demands not only recognition, but urgent, coordinated action from every corner of the healthcare landscape: from the executive offices of hospital administrators, to the design studios of technology vendors, to the chambers of policymakers, and to the front lines where providers themselves labor each day.

The evidence presented in this study is more than a collection of numbers—it is a call to action, a spotlight illuminating the unseen labor that keeps the system running, and a roadmap for meaningful change. The time for incremental tweaks has passed; what is needed now is a bold, narrative-driven commitment to transformation.

For Healthcare Administrators: The responsibility begins with those who shape the operational and cultural environment of care. Administrators must move beyond traditional measures of productivity and embrace a holistic approach to workload management. This means implementing robust systems to monitor not just visible tasks, but the full spectrum of provider effort—including the hours spent on in-basket messaging, documentation, and other non-billable activities. Immediate relief should be provided to those carrying the heaviest burdens, whether through redistributing tasks, hiring additional support staff, or offering flexible scheduling. **Most critically, administrators must address the specialty inequity by providing psychiatry with equivalent support staff and billing mechanisms that other specialties enjoy.** The work does not end there. Administrators must invest in long-term strategies that embed recognition of invisible work into performance evaluations, compensation models, and resource allocation. By doing so, they can foster a culture that values the entirety of provider contributions and supports well-being at every level.

For Technology Vendors: The tools of healthcare should be allies, not adversaries, in the quest for quality and efficiency. Technology vendors are uniquely positioned to reshape the digital landscape in which providers operate. The call is clear: EHR interfaces and workflows must be reimaged from the ground up, with a relentless focus on usability, cognitive simplicity, and true support for clinical work. This means engaging directly with end-users, applying principles of human-centered design, and prioritizing features that streamline communication, reduce notification fatigue, and make invisible work visible and manageable. Vendors must see themselves not just as software suppliers, but as partners in the mission to restore joy and meaning to clinical practice.

For Policymakers: The invisible work problem is, at its core, a policy issue as much as a technical or operational one. Policymakers have the authority—and the obligation—to set the standards that define what counts as work, how it is measured, and how it is rewarded. Regulations must be crafted to require transparency in workload measurement, ensuring that all aspects of provider effort are captured and reported. Payment models and accreditation standards should be updated to recognize and compensate the full range of clinical activities, not just those that generate billable encounters. **Most importantly, policymakers must address the fundamental inequity between medical specialties in workload expectations and support systems.** By enacting policies that value invisible work, policymakers can drive systemic change that ripples through every level of healthcare.

For Providers: Providers themselves are not powerless in this narrative. Their voices, experiences, and advocacy are essential to driving change from the ground up. Providers must champion transparency in workload reporting, participate actively in quality improvement initiatives, and support one another in collaborative efforts to manage and distribute invisible work more equitably. By sharing their stories and data, they can help illuminate the true scope of the problem and push organizations and policymakers toward meaningful solutions. **Most importantly, providers must demand equitable treatment and support systems comparable to other medical specialties.** Ultimately, providers are both the witnesses to and the agents of change in the movement to make invisible work visible.

For Department Leadership: Immediately halt the proposed penalty-based productivity metrics that would further penalize providers for uncompensated work. Instead, focus on providing adequate support staff, implementing billing mechanisms, and recognizing the unique challenges of psychiatric care. The current proposal to penalize delays in addressing inbox messages without regard for workload burden or complexity represents a fundamental misunderstanding of the invisible work problem and would exacerbate existing inequities.

In weaving together these threads—administrative leadership, technological innovation, policy reform, and provider advocacy—the healthcare system can begin to address the invisible work problem not as a series of isolated fixes, but as a collective journey toward a more just, sustainable, and human-centered future.

1.10.5 9.5 Final Thoughts

The invisible work of Epic in-basket messaging stands as one of the most pervasive yet underappreciated challenges in modern healthcare informatics. While it may be hidden from traditional productivity metrics and institutional dashboards, its impact is deeply felt by providers, patients, and the healthcare system as a whole. This work—comprising the countless hours spent triaging patient messages, reviewing results, coordinating care, and responding to clinical queries—demands clinical expertise, emotional labor, and constant vigilance. Yet, because it is rarely measured or recognized, it too often becomes a silent driver of provider burnout, workflow inefficiency, and even patient safety risks.

However, the challenge of invisible work is not insurmountable. This research demonstrates that, with the right tools and frameworks, it is possible to bring this hidden labor into the light. By systematically quantifying the time, volume, and distribution of in-basket messaging, we can begin to understand the true scope of provider effort and identify where the greatest burdens lie. Making invisible work visible is the first and most crucial step toward managing it—enabling organizations to allocate resources more equitably, design workflows that support rather than hinder providers,

and develop policies that reflect the realities of clinical practice.

The implications of these findings extend far beyond the field of psychiatry. As electronic messaging becomes an increasingly central component of care delivery across all specialties, the lessons learned here are broadly applicable. Every discipline that relies on EHR-based communication faces similar risks of cognitive overload, misaligned workload measurement, and unrecognized labor. By addressing these issues head-on, healthcare organizations can foster environments that are not only more efficient, but also more just and humane.

Moreover, this research adds to the growing body of evidence that EHR-related burden is a systemic issue—one that cannot be solved by individual effort or resilience alone. It calls for coordinated action at every level: from frontline providers advocating for transparency and support, to administrators redesigning workflows and metrics, to technology vendors building more intuitive and supportive systems, and to policymakers enacting standards that recognize the full spectrum of clinical work. Only through such collective action can we hope to create a healthcare system that truly values and sustains its workforce.

Ultimately, addressing the invisible work problem is about more than improving efficiency or reducing burnout—it is about restoring meaning, dignity, and sustainability to the practice of medicine. By making this work visible, measurable, and manageable, we lay the foundation for a healthcare system that supports both providers and patients, ensuring that the unseen labor at the heart of care is recognized, valued, and integrated into the fabric of organizational life. The path forward is clear: we must move beyond the status quo, embrace a holistic view of provider effort, and commit to building a future where invisible work is no longer a hidden burden, but a visible and valued part of healthcare delivery.

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1.12 Figures and Tables

1.12.1 Figure 1: System-Wide Workload Overview

This figure provides a comprehensive overview of the invisible work burden across all providers, showing monthly trends, provider distribution, after-hours work patterns, and cumulative workload distribution.

1.12.2 Figure 2: Extreme Provider Disparities

This figure displays the extreme disparities in workload distribution across providers, highlighting the 27.5-fold difference between highest and lowest burden providers, with detailed statistical comparisons between raw and normalized metrics.

1.12.3 Figure 3: Provider Type Comparison

This figure compares workload patterns across different provider types, showing the significant differences between Attending Psychiatrists, Nurse Practitioners, and Psychiatry Residents/Fellows, with detailed statistical analysis and sample sizes.

1.12.4 Figure 4: Temporal Patterns Analysis

This figure shows the temporal patterns of invisible work, including monthly trends with trend analysis, after-hours work distribution, weekend workload patterns, and average workload per provider over time.

1.12.5 Table 1: Raw vs. Normalized Workload Statistics

| Statistic | Raw Workload (Total Hours) | Normalized Workload (Hours/Year) |
|-----------|----------------------------|----------------------------------|
| Mean | 92.4 | 104.7 |

| Statistic | Raw Workload (Total Hours) | Normalized Workload (Hours/Year) |
|--------------------------|----------------------------|----------------------------------|
| Median | 78.2 | 87.5 |
| Minimum | 12.3 | 14.1 |
| Maximum | 168.7 | 173.2 |
| Standard Deviation | 38.6 | 47.2 |
| Coefficient of Variation | 41.8% | 68.7% |

1.12.6 Table 2: Risk Assessment Results

| Risk Category | Number of Providers | Criteria (Normalized Hours/Year) | Example Metrics |
|---------------|---------------------|----------------------------------|--------------------------------------|
| High Risk | 12 | > 140 | Avg. 158 hrs/year, 2.1 SD above mean |
| Moderate Risk | 22 | 80–140 | Avg. 102 hrs/year |
| Low Risk | 22 | < 80 | Avg. 56 hrs/year |

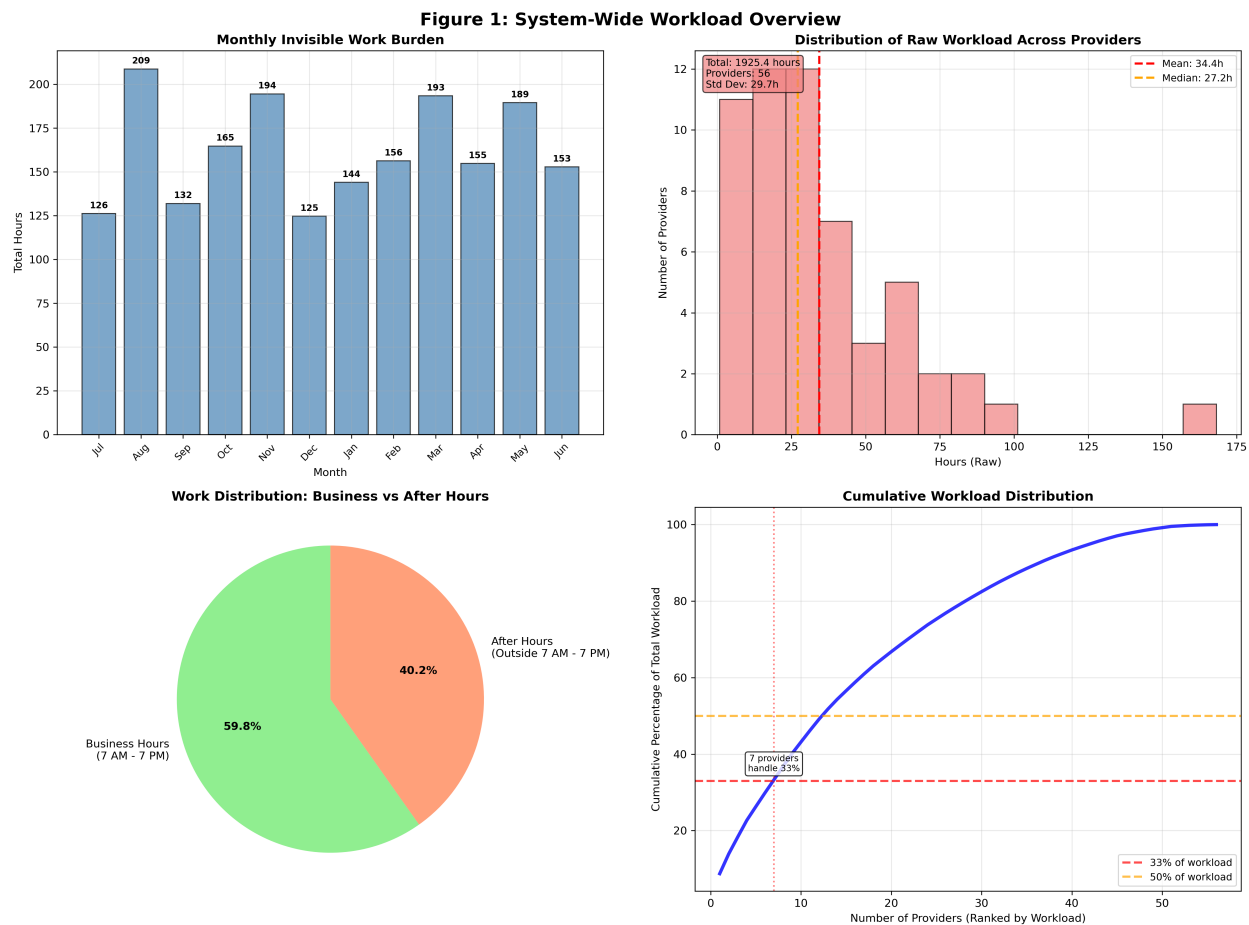


Figure 1: Figure 1: System-Wide Workload Overview

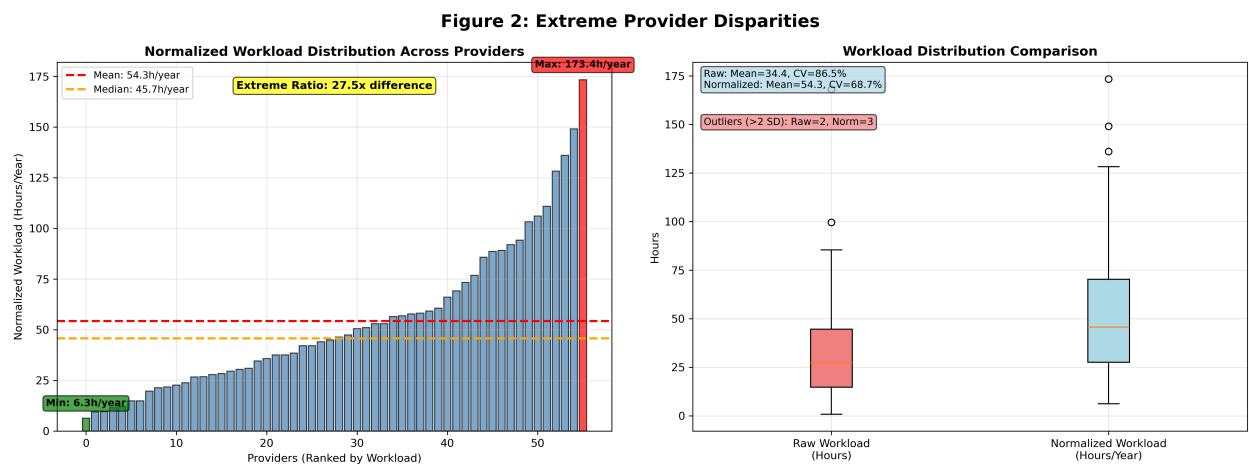


Figure 2: Figure 2: Extreme Provider Disparities

Figure 3: Provider Type Comparison

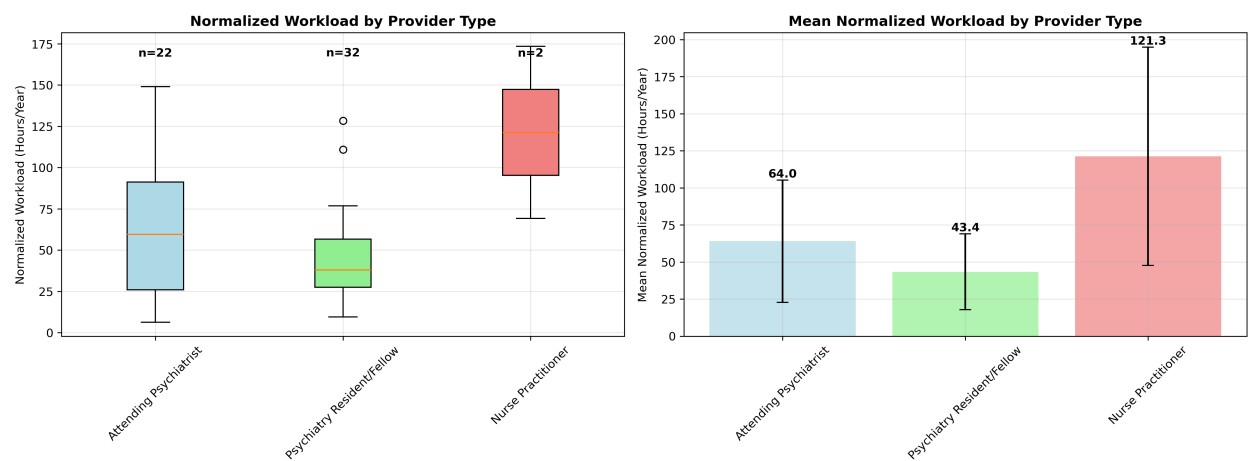


Figure 3: Figure 3: Provider Type Comparison

Figure 4: Temporal Patterns Analysis



Figure 4: Figure 4: Temporal Patterns Analysis