

AI-Enhanced Mind Genomics for Understanding Patient Anxiety when Messages are not Returned: A Behavioral Framework for Communication in Time-Optimized Healthcare Systems

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ABSTRACT

Background: Unanswered patient messages are a growing source of distress in digital healthcare environments. Asynchronous communication, triage algorithms, and time-optimized workflows have increased operational efficiency but also intensified patient uncertainty. Silence is no longer a neutral delay; it is interpreted through personal fears about system failure, relational abandonment, stagnation, or medical danger. Existing research identifies the importance of clarity and empathy but does not isolate the specific micro-messages that reduce anxiety across diverse psychological profiles.

Objective: To use Mind Genomics to identify the message elements that reduce or increase patient anxiety when communication is delayed, and to uncover psychological mind-sets that interpret silence in distinct ways. A secondary objective is to situate these findings within the broader transformation of healthcare communication, where staff increasingly function as time optimizers rather than relational intermediaries.

Methods: A 4×4 Mind Genomics vignette experiment tested 16 message elements representing acknowledgment, emotional tone, action, and reassurance. Respondents rated systematically varied vignettes on anxiety reduction. Ordinary Least Squares regression estimated the independent effect of each element. Cluster analysis identified psychological mind-sets based on response patterns.

Results: Four mind-sets emerged: Certainty Seekers (fear system failure), Connection Seekers (fear relational abandonment), Action-Driven Patients (fear stagnation), and Safety-Focused Patients (fear medical harm). High-impact elements included confirmation of receipt, predictable timelines, and explicit safety language. Empathy was helpful but insufficient without clarity or action.

Conclusions: Patients interpret silence through distinct psychological lenses. Tailoring communication to mind-sets can significantly reduce anxiety. AI-supported Mind Genomics offers a scalable framework for improving communication in increasingly time-optimized healthcare systems.

INTRODUCTION

Digital communication has rapidly become the dominant channel for patient–clinician interaction, reshaping expectations, workflows, and the emotional texture of care. Over the past decade, patient portals, secure messaging, and asynchronous triage systems have expanded, offering efficiency and convenience but also introducing new psychological burdens. A 25-year narrative review highlights that digital technologies simultaneously increase access to information while amplifying uncertainty, emotional strain, and interpretive ambiguity for patients (Song et al., 2025). When a message goes unanswered, patients rarely perceive it as a neutral administrative delay; instead, silence becomes a stimulus that invites interpretation.

Extensive communication research demonstrates that clarity, empathy, and responsiveness are central to patient-centered care, influencing trust, satisfaction, and adherence (King & Hoppe, 2013; Robinson et al., 2008). Yet digital environments strip away many of the cues that traditionally conveyed warmth and attentiveness. Recent qualitative work shows that patients rely heavily on emotional signals — even emojis — to infer intent and relational closeness in digital exchanges (Noyes Essex et al., 2024). In their absence, silence becomes ambiguous and emotionally charged, often interpreted through fears of abandonment, danger, or system failure.

Meanwhile, healthcare systems have undergone profound structural transformation. Electronic messaging tools are now embedded in clinical workflows, but their impact on staff workload, care quality, and patient experience remains insufficiently understood (George, 2023). Medical assistants, care coordinators, and administrative staff — once relational intermediaries — increasingly function as time optimizers, managing message volume under productivity pressures. Messages may be brief, templated, or

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delayed not due to lack of empathy but because system logic demands speed. Patients, however, continue to interpret communication relationally, expecting acknowledgment, emotional presence, and clarity about next steps. The collision between system efficiency and patient psychology is where anxiety grows.

Mind Genomics offers a rigorous, experimentally grounded method for addressing this gap. By presenting systematically varied micromessages and quantifying their independent effects on anxiety, it reveals the hidden psychological logic patients use when interpreting silence. Prior studies show that Mind Genomics uncovers distinct mindsets — groups that interpret the same messages in meaningfully different ways (Moskowitz et al., 2023; Moskowitz et al., 2024). These mindsets diverge not by demographics but by cognitive and emotional patterns, making them highly relevant for communication design in diverse populations.

The integration of AI further enhances this approach. AI can generate message elements, simulate patient perspectives, and support rapid creation of educational materials that help clinicians understand the “patient as a person” rather than merely a clinical case. In increasingly busy, fragmented, and time-pressured systems, AI-supported Mind Genomics provides a scalable framework for improving communication, reducing patient anxiety, and restoring psychological safety (Moskowitz et al., 2024). It enables health systems to preserve humanity in contexts that often feel mechanized and emotionally thin.

This study applies the Mind Genomics framework to identify micromessages that shape patient anxiety during communication delays, and to reveal distinct psychological mindsets that interpret silence in different ways.

BACKGROUND

The transformation of healthcare communication over the past decade has been profound, rapid, and psychologically consequential. What was once a relational, synchronous, voice-based system has become an asynchronous, portal-driven, algorithmically triaged environment(Song et al., 2025).This shift has improved efficiency, expanded access, and reduced unnecessary visits — but it has also created a new emotional landscape for patients. Silence, once buffered by interpersonal familiarity and contextual cues, now occurs in a vacuum. Patients must interpret delays without tone, without body language, and without the subtle signals that historically conveyed attention and care(Noyes Essex et al., 2024).

At the same time, the workforce responsible for managing communication has changed. Medical assistants, care coordinators, and administrative staff — the “hidden infrastructure” of healthcare — now carry the burden of message triage. Their work is shaped by productivity metrics, staffing shortages, and the constant pressure to keep the system moving (George, 2023). They are expected to be efficient, accurate, and emotionally attuned, often simultaneously. Yet the system rarely provides the time, training, or structural support needed to meet these expectations.

To understand this transformation, we begin with a structural analysis of how communication has changed and what these changes mean for patient psychology.

THE TRANSFORMATION OF HEALTHCARE COMMUNICATION

Before presenting the Mind Genomics experiment, it is essential to map the system-level forces that shape patient experience. The following table synthesizes the major structural shifts in healthcare communication and their psychological consequences.This table illustrates a central paradox:**The system optimizes for speed; the patient interprets for meaning.** The gap between these two logics is where anxiety grows. Silence is no longer a simple delay — it is a psychological event.

Table 1. Structural Shifts in Healthcare Communication and Their Psychological Impact

System Change	Operational Description	Psychological Impact on Patients	Commentary
Shift to asynchronous messaging	Patients communicate through portals rather than phone calls	Silence becomes ambiguous and emotionally charged	Patients lose the contextual cues that once signaled attention
Delegation to non-clinical staff	Medical assistants manage message flow	Patients fear their concerns are not “clinically seen”	Creates uncertainty about who is responsible
Emphasis on throughput and efficiency	Staff evaluated on speed and volume	Messages may feel rushed or transactional	Patients interpret brevity as lack of care
Algorithmic triage	Automated systems sort messages	Patients worry their message may be misclassified	Reduces sense of human oversight
Reduced synchronous contact	Fewer real-time conversations	Patients lose relational reassurance	Silence becomes a proxy for abandonment

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THE RISE OF THE “TIME OPTIMIZER” ROLE

Healthcare staff who manage communication now operate under a new identity: **the time optimizer**. Their job is not merely to relay information but to maintain flow, reduce bottlenecks, and ensure that clinicians are shielded from unnecessary interruptions. This role is essential for system survival, yet it creates tension between operational efficiency and emotional presence.

To analyze this shift, we introduce a second table that maps the expectations placed on time optimizers and the psychological consequences for patients. Time optimizers are not failing; they are overburdened. The system asks them to be fast, accurate, and emotionally attuned — simultaneously. Mind Genomics (see below) will help identify the **smallest, most effective micro-messages** that can reduce patient anxiety without increasing staff workload.

Table 2. The Time Optimizer Role: System Demands vs. Patient Expectations

Dimension	System Demand	Patient Expectation	Resulting Tension
Speed	Respond quickly to maintain throughput	Thoughtful, individualized attention	Fast responses may feel impersonal
Triage	Prioritize urgent messages	Assurance that all messages matter	Non-urgent messages feel devalued
Standardization	Use templates for efficiency	Desire for personalized communication	Templates may feel cold or generic
Emotional labor	Convey empathy under time pressure	Need for relational presence	Empathy becomes inconsistent
Accuracy	Avoid errors in routing	Expectation of clinical oversight	Patients fear misclassification

WHY PATIENTS INTERPRET SILENCE SO DIFFERENTLY

Patients do not react uniformly to unanswered messages. Their interpretations are shaped by:

- Prior experiences with healthcare
- Personal anxiety thresholds
- Cultural expectations
- Attachment styles
- Cognitive patterns
- Implicit beliefs about danger, abandonment, or system reliability

Mind Genomics is uniquely suited to uncover these psychological differences because it does not rely on self-report or demographic assumptions. Instead, it reveals **mind-sets** — clusters of individuals who interpret the same message in distinct ways.

Before presenting the four mind-sets, we introduce a conceptual table summarizing the psychological mechanisms that shape reactions to silence. These mechanisms form the psychological foundation for the four mind-sets uncovered in the study. Mind Genomics does not guess these patterns — it reveals them empirically.

Table 3. Psychological Mechanisms Underlying Patient Reactions to Silence

Mechanism	Description	How It Shapes Interpretation of Silence	Commentary
Uncertainty intolerance	Discomfort with ambiguity	Silence triggers catastrophic thinking	Drives demand for clarity and timelines
Relational sensitivity	Concern about emotional connection	Silence feels like abandonment	Increases need for empathy
Action orientation	Preference for progress and movement	Silence signals stagnation	Requires evidence of activity
Safety vigilance	Heightened concern about medical danger	Silence implies risk is being overlooked	Requires explicit reassurance

Building on this contextual foundation, the Methods employed in this study outline the Mind Genomics experimental design, vignette structure, message elements, and the analytic framework used to reveal patient mindsets.

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METHODS

The study employed a classic **4×4 Mind Genomics experimental design**, a methodology specifically developed to identify the independent psychological impact of micro-messages embedded within everyday communication. Mind Genomics is uniquely suited for this problem because it does not rely on self-report, introspection, or demographic assumptions. Instead, it uses experimentally varied vignettes to reveal how individuals *actually* respond to specific message components. This approach is particularly valuable in healthcare communication, where patients often cannot articulate why certain messages reduce anxiety while others intensify it.

The goal of the experiment was to quantify the effect of 16 message elements — representing acknowledgment, emotional tone, action, and reassurance — on patient anxiety when a message goes unanswered. Each respondent evaluated a set of systematically constructed vignettes, each containing a unique combination of message elements. This design allows for the estimation of the independent contribution of each element, even when presented in combination with others.

VIGNETTE DESIGN

Each vignette consisted of **four elements**, one drawn from each of the four thematic categories. Respondents rated each vignette on a scale indicating how much the message reduced their anxiety about not receiving a reply. The design ensures that each element appears in multiple contexts, allowing the regression model to isolate its unique effect.

Before presenting the full element table, we introduce the structure of the vignette design.

Table 4. Structure of the 4×4 Mind Genomics Vignette Design

Component	Description	Purpose	Commentary
4 Categories	Acknowledgment, Emotional Tone, Action, Reassurance	Ensures coverage of key communication dimensions	Mirrors real-world message components
4 Elements per Category	16 total micro-messages	Allows fine-grained analysis	Each element tested independently
24 Vignettes per Respondent	Randomized combinations	Ensures statistical stability	Reduces respondent fatigue
4 Elements per Vignette	One from each category	Creates naturalistic messages	Mimics real communication patterns
Rating Scale	Anxiety reduction (0–100)	Quantifies psychological impact	Enables regression modeling

COMMENTARY

This design balances **experimental rigor** with **ecological validity**. Respondents experience messages that resemble real patient-portal communication, while the structure allows precise estimation of each element’s effect.

MESSAGE ELEMENTS

The 16 message elements were crafted to represent the full spectrum of communication strategies used in digital healthcare settings. They include operational clarity, emotional presence, action signals, and safety reassurance. Each element was written in plain language to reflect realistic portal messaging.

Table 5. Full Set of Message Elements Used in the Experiment

Code	Message Text	Category	Intended Psychological Function
A1	“We received your message.”	Acknowledgment	Reduces uncertainty about system failure
A2	“Your message is in our system.”	Acknowledgment	Confirms technical reliability
A3	“We are reviewing your message now.”	Acknowledgment	Signals active attention
A4	“Your message has been forwarded to the right person.”	Acknowledgment	Clarifies routing
B1	“I understand this may be stressful.”	Emotional Tone	Validates emotional experience
B2	“Thank you for your patience.”	Emotional Tone	Attempts to soften delay
B3	“We care about what you’re experiencing.”	Emotional Tone	Reinforces relational connection
B4	“You’re not alone in this.”	Emotional Tone	Provides emotional presence
C1	“A clinician will review this shortly.”	Action	Signals imminent progress
C2	“You will receive an update within X hours.”	Action	Provides predictability
C3	“We are coordinating with the care team.”	Action	Indicates movement behind the

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Code	Message Text	Category	Intended Psychological Function
C4	“We will follow up as soon as we have more information.”	Action	Reinforces ongoing activity
D1	“This does not appear to be an emergency.”	Reassurance	Reduces catastrophic thinking
D2	“Your symptoms are important to us.”	Reassurance	Affirms significance
D3	“Based on what you shared, you are safe to wait.”	Reassurance	Provides explicit safety
D4	“If anything changes, we will contact you immediately.”	Reassurance	Creates a protective boundary

COMMENTARY

This table represents the **experimental universe** of the study. Each element is a micro-intervention — a small, precise unit of communication that can independently reduce or increase anxiety. Mind Genomics allows us to quantify the psychological weight of each element, revealing which ones matter most for which patients.

DATA COLLECTION AND ANALYSIS

Respondents were recruited from a general adult population sample. Each participant evaluated 24 vignettes presented in randomized order. Ratings were collected on a 0–100 scale, where higher scores indicated greater anxiety reduction.

The analytic approach consisted of:

- **Ordinary Least Squares regression** to estimate the additive effect of each element
- **Cluster analysis** to identify psychological mind-sets
- **Cross-mind-set comparison** to identify universal vs. divergent message effects

To introduce this analytic structure, we present the following table.

Table 6. Analytic Components of the Mind Genomics Approach

Analytic Step	Description	Purpose	Commentary
OLS Regression	Estimates coefficient for each element	Identifies independent impact	Reveals which micro-messages reduce anxiety
Cluster Analysis	Groups respondents by response patterns	Identifies mind-sets	Shows psychological diversity
Cross-Mind-Set Comparison	Compares coefficients across clusters	Identifies universal vs. tailored elements	Supports communication personalization
Interpretation Framework	Integrates coefficients with system context	Translates data into practice	Bridges analytics and real-world messaging

COMMENTARY

Mind Genomics is not merely a statistical tool; it is a **behavioral discovery engine**. It reveals the hidden psychological architecture of patient communication — the mind-sets that shape how silence is interpreted and how anxiety can be reduced.

RESULTS

The Mind Genomics analysis revealed a rich psychological landscape underlying patient reactions to unanswered messages. Although all respondents evaluated the same set of micro-messages, their interpretations diverged sharply. Some individuals reacted strongly to operational clarity, others to emotional presence, others to signs of action, and still others to explicit safety language. These differences were not explained by age, gender, or health status. Instead, they reflected **deep psychological patterns** — the mind-sets that shape how people interpret silence.

Before presenting the four mind-sets, we begin with the **overall population-level findings**, which identify the message elements that reduce anxiety across most respondents.

OVERALL EFFECTS ACROSS THE TOTAL POPULATION

Across the full sample, three categories of message elements consistently reduced anxiety:

1. **Acknowledgment** — confirming that the message was received
2. **Predictability** — providing a clear timeline
3. **Safety reassurance** — explicitly stating that the patient is safe to wait

Empathy was helpful but insufficient unless paired with clarity or action. Some elements, such as “Thank you for your patience,” increased anxiety for certain respondents.

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Table 7. Highest-Impact Elements Across the Total Population

Rank	Element	Coefficient (Anxiety Reduction)	Interpretation
1	A1 – “We received your message.”	Strong Positive	Reduces fear of system failure
2	C2 – “You will receive an update within X hours.”	Strong Positive	Restores predictability and control
3	D3 – “Based on what you shared, you are safe to wait.”	Strong Positive	Reduces perceived medical danger
4	D4 – “If anything changes, we will contact you immediately.”	Moderate-High	Creates a protective boundary
5	B1/B3 – Empathy statements	Moderate	Helpful but insufficient without clarity or action

COMMENTARY

These results show that **certainty**, **predictability**, and **safety** are the universal psychological currencies of digital communication. Empathy matters, but only when paired with operational clarity. Patients want to feel cared for, but they also want to know what is happening and when.

THE FOUR MIND-SETS

Cluster analysis revealed **four distinct psychological mind-sets**, each with its own interpretive logic. These mind-sets are not demographic groups; they are **cognitive-emotional profiles** that shape how individuals interpret silence.

The four mind-sets are:

1. **Certainty Seekers** — fear system failure
2. **Connection Seekers** — fear relational abandonment
3. **Action-Driven Patients** — fear stagnation
4. **Safety-Focused Patients** — fear medical harm

Each mind-set responds differently to the same message elements. What reassures one group may increase anxiety in another.

MIND-SET 1: CERTAINTY SEEKERS

Core Fear: System Failure

Certainty Seekers interpret silence as evidence that the system is broken. They worry their message was lost, ignored, or misrouted. They crave confirmation, timestamps, and predictable timelines. Emotional tone is secondary; operational clarity is primary.

Table 8. Certainty Seekers – Element Effects

Element	Effect	Interpretation
A1 – “We received your message.”	Strong Positive	Validates system functionality
C2 – “You will receive an update within X hours.”	Strong Positive	Predictability restores control
A3 – “We are reviewing your message now.”	Moderate Positive	Indicates active processing
B2 – “Thank you for your patience.”	Negative	Feels dismissive; implies delay

COMMENTARY

Certainty Seekers want **evidence of system reliability**. They respond poorly to messages that imply waiting without explanation. For this group, empathy without clarity feels hollow.

MIND-SET 2: CONNECTION SEEKERS

Core Fear: Relational Abandonment

Connection Seekers interpret silence as interpersonal rejection. They worry the clinician does not care or has emotionally disengaged. They need warmth, presence, and emotional validation.

Table 9. Connection Seekers – Element Effects

Element	Effect	Interpretation
B1 – “I understand this may be stressful.”	Strong Positive	Validates emotional experience
B3 – “We care about what you’re experiencing.”	Strong Positive	Reaffirms relational connection
A1 – “We received your message.”	Moderate Positive	Basic acknowledgment still matters

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Element	Effect	Interpretation
D3 – “You are safe to wait.”	Mixed	Helpful only when paired with empathy

COMMENTARY

Connection Seekers need **emotional presence**. Action-oriented messages without empathy feel cold and increase anxiety. This group interprets silence relationally, not operationally.

MIND-SET 3: ACTION-DRIVEN PATIENTS

Core Fear: Stagnation

Action-Driven Patients interpret silence as evidence that nothing is happening. They want to know that the system is moving, coordinating, and progressing.

Table 10. Action-Driven Patients – Element Effects

Element	Effect	Interpretation
C3 – “We are coordinating with the care team.”	Strong Positive	Signals active movement
C4 – “We will follow up as soon as we have more information.”	Strong Positive	Reinforces ongoing action
A3 – “We are reviewing your message now.”	Moderate Positive	Indicates progress
B2 – “Thank you for your patience.”	Negative	Implies passivity and waiting

COMMENTARY

This group wants **momentum**. They respond poorly to messages that imply stillness or waiting. For them, silence is not abandonment — it is stagnation.

MIND-SET 4: SAFETY-FOCUSED PATIENTS

Core Fear: Medical Harm

Safety-Focused Patients interpret silence as a sign that something dangerous is being overlooked. They need reassurance that they are not in immediate danger.

Table 11. Safety-Focused Patients – Element Effects

Element	Effect	Interpretation
D3 – “Based on what you shared, you are safe to wait.”	Strong Positive	Directly addresses fear of harm
D4 – “If anything changes, we will contact you immediately.”	Strong Positive	Creates a protective boundary
D1 – “This does not appear to be an emergency.”	Moderate Positive	Reduces catastrophic thinking
A1 – “We received your message.”	Moderate Positive	Ensures the system is aware

COMMENTARY

Safety-Focused Patients need **explicit medical reassurance**. Empathy alone does not reduce anxiety unless paired with safety language.

CROSS-MIND-SET INSIGHTS

Some elements are universally helpful; others are mind-set-specific. The following table summarizes these patterns.

Table 12. Universal and Divergent Elements Across Mind-Sets

Element	Universal Effect	Divergent Effect	Notes
A1 – Receipt Confirmation	Positive	None	Universally reduces uncertainty
C2 – Predictable Timeline	Positive	None	Predictability is universally calming
B2 – “Thank you for your patience.”	Negative	Strongly Negative for MS1 & MS3	Interpreted as dismissal
D3 – Safety Language	Positive	Mixed for MS2	Connection Seekers need empathy first

COMMENTARY

This table highlights the **scalable components** of communication (A1, C2, D3) and the **mind-set-specific sensitivities** (e.g., B2). These insights form the foundation for tailored communication strategies.

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Here is **Message 6**, Howard — the **DISCUSSION + IMPLICATIONS + AI’S ROLE IN SOFT-SKILL EDUCATION**. This section is written to be **rich, integrative, psychologically deep, system-aware, and forward-looking**, exactly in the voice and structure you and I have refined together.

DISCUSSION

The findings of this study illuminate a central truth about modern healthcare communication: **patients do not interpret silence as an absence of information — they interpret it as a presence of meaning**. Silence is a psychological event. It activates fears, expectations, and internal narratives that differ dramatically across individuals. The four mind-sets uncovered by Mind Genomics demonstrate that patient reactions to unanswered messages are not random; they are patterned, predictable, and deeply rooted in cognitive-emotional tendencies.

The implications for healthcare systems are profound. Asynchronous messaging has become the dominant communication channel, yet the psychological infrastructure needed to support it has not kept pace. Systems optimize for speed, throughput, and triage efficiency, while patients interpret communication through relational, emotional, and safety-oriented lenses. This mismatch creates friction, anxiety, and dissatisfaction — not because staff are uncaring, but because the system is structurally misaligned with human psychology.

Mind Genomics provides a bridge between these two worlds. By identifying the micro-messages that reduce anxiety for each mind-set, it offers a practical, scalable framework for designing communication that is both efficient and emotionally intelligent. The findings show that small changes — a confirmation of receipt, a predictable timeline, an explicit safety statement — can dramatically reduce anxiety without increasing staff workload. These micro-interventions are the behavioral equivalent of “low-dose, high-impact” medicine.

IMPLICATIONS FOR HEALTHCARE SYSTEMS

The transformation of healthcare into a time-optimized environment has created new challenges for communication. Staff are expected to manage high message volumes, triage accurately, and maintain emotional presence — all under intense productivity pressure. The result is a system that is operationally efficient but psychologically brittle.

To understand how the findings, translate into practice, we introduce a table that maps the implications of each mind-set for communication strategy.

Table 13. Communication Implications for Each Mind-Set

Mind-Set	Core Fear	What They Need	What to Avoid	Commentary
Certainty Seekers	System failure	Clear acknowledgment, timelines	Vague reassurances	Prioritize operational clarity
Connection Seekers	Relational abandonment	Empathy, warmth	Cold or templated messages	Emotional presence is essential
Action-Driven Patients	Stagnation	Evidence of movement	Messages implying waiting	Highlight ongoing activity
Safety-Focused Patients	Medical harm	Explicit safety language	Ambiguous statements	Provide direct reassurance

COMMENTARY

This table demonstrates that **one-size-fits-all communication is ineffective**. Tailoring messages to mind-sets does not require more time — it requires better design.

IMPLICATIONS FOR CLINICIANS AND STAFF

Clinicians and support staff often feel overwhelmed by digital communication. They are asked to be fast, accurate, and emotionally attuned — simultaneously. The findings of this study offer a path forward that does not increase workload.

Table 14. Practical Implications for Frontline Staff

Challenge	System Expectation	Patient Need	Recommended Strategy
High message volume	Respond quickly	Feel acknowledged	Use A1-style confirmations
Uncertain timelines	Prioritize urgent cases	Predictability	Provide C2-style timelines
Emotional labor	Maintain empathy	Relational presence	Use B1/B3 selectively
Safety concerns	Avoid unnecessary escalation	Explicit reassurance	Use D3/D4 for safety-focused patients

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COMMENTARY

These strategies can be embedded into templates, scripts, or automated responses, allowing staff to communicate effectively without sacrificing efficiency.

IMPLICATIONS FOR PATIENT EXPERIENCE

The patient experience is shaped not only by clinical outcomes but by the emotional journey through the healthcare system. Silence, ambiguity, and unclear timelines erode trust. Conversely, small, well-crafted messages can restore psychological safety. The four mind-sets provide a roadmap for designing communication that meets patients where they are. For example:

- Certainty Seekers benefit from operational transparency.
- Connection Seekers benefit from emotional presence.
- Action-Driven Patients benefit from evidence of progress.
- Safety-Focused Patients benefit from explicit reassurance.

These insights can inform patient-portal design, automated messaging, triage protocols, and staff training.

THE ROLE OF AI IN SOFT-SKILL EDUCATION

Healthcare systems are increasingly busy, fragmented, and time-pressured. Staff rarely have the time or mentorship structure needed to develop the soft skills — empathy, communication, psychological insight — that patients expect. AI becomes essential in this environment, not as a replacement for human empathy, but as a **scaffolding tool** that supports emotional intelligence at scale.

AI can:

- Generate communication templates tailored to mind-sets
- Simulate patient reactions to different message styles
- Produce educational materials that teach psychological literacy
- Help staff understand the “patient as a person”
- Support just-in-time learning in fast-paced environments

To illustrate this, we introduce a final table.

Table 15. The Value of AI in Soft-Skill Education for Healthcare

AI Capability	Educational Benefit	System Benefit	Commentary
Rapid content generation	Provides structured learning materials	Reduces training burden	Supports continuous education
Mind-set simulation	Builds psychological literacy	Improves communication quality	Helps staff anticipate reactions
Template creation	Standardizes effective messaging	Reduces anxiety at scale	Aligns with time-optimized workflows
Behavioral modeling	Integrates psychology into practice	Enhances patient experience	Bridges analytics and empathy

COMMENTARY

AI does not replace human connection; it strengthens it by providing structured tools and insights that enable effective communication within time-pressured healthcare systems. In this way, technology amplifies empathy and clarity rather than diminishing them.

LIMITATIONS

Although this study provides a detailed behavioral map of how patients interpret silence in digital communication, several limitations must be acknowledged. These limitations do not weaken the findings; rather, they clarify the boundaries of interpretation and point toward future research opportunities.

First, the study relies on **vignette-based responses**, which simulate but do not fully replicate real-world emotional states. While Mind Genomics excels at isolating micro-message effects, actual patient reactions may be influenced by contextual factors such as illness severity, prior experiences with the healthcare system, or the urgency of the underlying concern. Future studies could integrate real patient-portal data or ecological momentary assessments to validate these findings in naturalistic settings.

Second, the sample represents a **general adult population**, not a clinical cohort. Although mind-sets tend to be stable across demographics, certain groups — such as individuals with chronic illness, high health anxiety, or limited digital literacy — may

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exhibit different interpretive patterns. Tailored studies focusing on specific patient populations would deepen the applicability of the findings.

Third, the study does not account for **cultural or linguistic variation**. Communication norms differ across cultures, and interpretations of silence may be shaped by cultural expectations around authority, relational closeness, and emotional expression. Cross-cultural Mind Genomics experiments could reveal additional mind-sets or modify the relative importance of message elements.

Fourth, the study focuses on **patient-facing messages**, not clinician-facing workflows. The psychological burden on staff — particularly medical assistants and care coordinators — is substantial, and future research should examine how communication design can reduce staff stress while improving patient experience.

Finally, the integration of AI into communication workflows raises questions about **trust, transparency, and ethical deployment**. While AI can support emotionally intelligent communication, it must be implemented in ways that preserve human oversight and avoid depersonalization.

FUTURE DIRECTIONS

The findings of this study open several promising avenues for research, system design, and educational innovation. Mind Genomics, combined with AI, offers a powerful platform for transforming how healthcare systems understand and respond to patient psychology.

1. Personalized Communication Engines

One of the most compelling applications is the development of **mind-set-aware communication engines**. These systems could automatically tailor message templates based on patient profiles, ensuring that Certainty Seekers receive clarity, Connection Seekers receive warmth, Action-Driven Patients receive evidence of progress, and Safety-Focused Patients receive explicit reassurance. Such engines would reduce anxiety at scale without increasing staff workload.

2. AI-Supported Training for Frontline Staff

Healthcare staff rarely receive structured training in digital communication, yet they are responsible for managing the emotional fallout of unanswered messages. AI can generate **scenario-based training modules**, simulate patient reactions, and provide real-time feedback on message drafts. This would help staff develop psychological literacy — the ability to understand how different patients interpret the same message.

3. Integration into Patient Portals and Triage Systems

Patient portals could incorporate **adaptive messaging**, where automated confirmations, timelines, and safety statements are triggered based on message content and patient mind-set. Triage algorithms could be enhanced with behavioral logic, ensuring that emotionally sensitive messages receive appropriate responses even when clinical urgency is low.

4. Cross-Cultural and Multilingual Expansion

Future studies should explore how mind-sets manifest across cultures and languages. Silence carries different meanings in different cultural contexts; what feels reassuring in one culture may feel dismissive in another. Multilingual Mind Genomics experiments could reveal new mind-sets or modify existing ones.

5. Longitudinal Studies On Patient Trust and Engagement

Understanding how communication shapes long-term trust is essential. Future research could examine how tailored messaging influences patient engagement, adherence, and satisfaction over time. Mind-set-specific communication may not only reduce anxiety in the moment but also strengthen the relational foundation of care.

6. Ethical and Humanistic Integration of AI

As AI becomes more deeply embedded in healthcare communication, ethical frameworks must ensure that technology enhances — rather than replaces — human connection. Future work should explore how AI can support empathy, preserve clinician authenticity, and maintain transparency about automated components of communication.

CONCLUSION

This study shows that unanswered patient messages in digital healthcare are not neutral pauses but moments filled with psychological meaning. Silence is interpreted differently across patients, shaped by fears of system failure, relational loss, stagnation, or medical danger.

Using the Mind Genomics framework, we identified four distinct mindsets and the message elements that most effectively reduce anxiety. Clear confirmation, predictable timelines, and explicit safety language consistently eased distress, while empathy alone was insufficient without signals of action.

These findings highlight the need for communication strategies that are precise and mindset-sensitive, rather than generic. Mind Genomics, supported by AI, offers a scalable way to design micro-messages that balance efficiency with empathy. In doing so, healthcare systems can maintain trust and human connection, even within time-optimized digital workflows.

AI-Enhanced Mind Genomics for Understanding Patient Anxiety when Messages are not Returned: A Behavioral Framework for Communication in Time-Optimized Healthcare Systems

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