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Personality-Driven Adaptive Psychosomatic Treatment Planning via Artificial Intelligence

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A B S T R A C T

The objective of this study was to develop and empirically evaluate an artificial intelligence–based framework that integrates personality traits with psychosomatic symptom profiles to generate adaptive, personalized treatment plans in psychosomatic medicine. A mixed-methods, model-development study was conducted using clinical data from adult patients with psychosomatic complaints recruited from outpatient psychosomatic and psychological services in Taiwan. Standardized personality assessments, psychosomatic symptom measures, clinician-rated evaluations, and behavioral indicators were collected and integrated into a secure digital dataset. Machine learning techniques, including unsupervised clustering and supervised predictive modeling, were applied to identify latent personality–symptom patterns and to generate individualized treatment recommendations across multiple psychosomatic intervention modalities. Model performance was evaluated using cross-validation procedures, and explainable AI methods were employed to enhance interpretability and clinical transparency. Unsupervised learning identified four distinct personality–psychosomatic clusters characterized by differential trait configurations and symptom profiles. Predictive modeling demonstrated high classification accuracy and strong discriminative capacity in matching patients to optimal treatment modalities. Inferential analyses indicated that personality traits significantly contributed to treatment recommendation variance beyond symptom severity alone, and adaptive recommendations differed systematically across clusters, supporting the model's capacity for clinically meaningful personalization. The findings suggest that integrating personality traits into AI-driven psychosomatic treatment planning enables robust patient stratification, improves personalization of intervention strategies, and offers a scalable decision-support approach aligned with contemporary precision medicine principles. This framework represents a promising step toward adaptive, person-centered psychosomatic care that complements clinical expertise and supports iterative treatment optimization.

Keywords: *psychosomatic medicine; personality traits; artificial intelligence; adaptive treatment planning; personalized healthcare*

1. Introduction

Psychosomatic medicine is fundamentally concerned with the reciprocal influence of psychological processes and bodily symptoms, especially when distress is expressed through somatic pathways such as pain, gastrointestinal dysfunction, autonomic dysregulation, fatigue, or insomnia. Contemporary psychosomatic practice increasingly recognizes that many symptom presentations cannot be sufficiently understood or treated through biomedical mechanisms alone, because symptom onset, persistence, and relapse are often shaped by affective states, cognitive appraisal, interpersonal context, and stable personality dispositions. Recent conceptual and empirical work has reinforced that personality traits and related constructs—such as hardiness, perfectionism, Type D tendencies, and broader trait configurations—are meaningfully associated with stress reactivity and psychosomatic symptom burden, supporting the premise that psychosomatic illness is not merely "stress-related," but frequently "personality-mediated" in its expression and course (Abdolkarimi et al., 2024; Šnele et al., 2024). This framing is particularly salient in high-demand populations where chronic stress, emotional load, and occupational strain are prevalent. For example, evidence from healthcare workers has linked personality-related vulnerability patterns with psychosomatic symptoms and stress indicators, suggesting that trait-level differences shape both exposure to stress and the internal translation of stress into somatic experience (Abdolkarimi et al., 2024).

Within this broader psychosomatic landscape, chronic pain and persistent somatic symptoms illustrate how individual differences modulate symptom interpretation, coping, and help-seeking. Chronic pain is not only a sensory experience but a dynamic biopsychosocial phenomenon that varies across persons and within persons over time; affective fluctuations, threat appraisal, and emotion regulation capacities influence pain intensity and disability, highlighting the clinical value of models that can capture symptom dynamics at the individual level (Frumkin & Rodebaugh, 2021). Personality underpinnings have been proposed as key explanatory layers for chronic pain heterogeneity, including trait dispositions that bias attention toward bodily threat, amplify negative affect, or undermine restorative behaviors (Goli, 2023). Similarly, medically unexplained symptoms and persistent somatic complaints in primary care have been treated with behavioral modification approaches, but systematic evidence suggests outcomes depend on the fit between intervention components and patient-level characteristics, reinforcing the need for personalization rather than one-size-fits-all protocols (Leaviss et al., 2020). In gastrointestinal dysfunction, for instance, integrative psychosomatic interventions have shown benefits for distress and symptoms among individuals with Type D personality profiles, directly illustrating that personality-informed tailoring can influence therapeutic response (Bajestani et al., 2022). Sleep-related psychosomatic mechanisms also demonstrate trait-linked vulnerability, such as pathways through which psychosomatic status interacts with insomnia formation in conditions like gastroesophageal reflux disease, indicating that somatic syndromes may be sustained by psychophysiological loops that vary by person (Oparin et al., 2020).

At the diagnostic level, psychosomatic medicine has advanced beyond purely descriptive symptom lists toward clinimetric and research-based criteria that better represent psychosomatic complexity and guide personalized care. Clinimetric perspectives emphasize measurement sensitivity, staging, and clinically meaningful change rather than reliance on categorical labels alone, thereby supporting "personalized psychiatry" and "personalized psychosomatics" grounded in patient-specific profiles (Fava, 2022). Diagnostic approaches in psychosomatic medicine further underscore the necessity of structured frameworks that integrate symptom patterns, illness behavior, and psychological determinants, while remaining flexible enough to account for heterogeneity across age and comorbidity profiles (Fazekas, 2022). In older populations, the clinimetric properties of Diagnostic Criteria for Psychosomatic Research (DCPR) and related constructs have been examined, indicating that psychosomatic criteria can be meaningfully operationalized but require careful measurement calibration (Romaniello et al., 2023). Importantly, psychosomatic practice in Taiwan is currently engaging with integrated diagnostic approaches that align DCPR-R with DSM-5 classifications to improve clinical utility, clarify relationships with psychopathologies, and enhance quality-of-life assessment. This integration provides a timely clinical and methodological foundation for Taiwan-based psychosomatic personalization efforts that require structured, measurement-informed inputs for decision support (Huang et al., 2025).

Personality measurement itself has also evolved in psychosomatic contexts, moving from broad traits alone to more nuanced assessments of personality functioning and

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related capacities that influence interpersonal stress, self-regulation, and emotional awareness. Assessment of personality functioning has been highlighted as clinically relevant in psychosomatic medicine because dysfunction in identity, affect regulation, and relationships can shape symptom expression, healthcare utilization, and adherence patterns (Wagner-Skacel et al., 2022). In parallel, constructs closely related to psychosomatics—such as alexithymia—continue to undergo conceptual refinement, reflecting ongoing debates about how best to model emotional awareness deficits that may predispose individuals to somatic amplification and difficulties in symptom meaning-making (Taylor & Bagby, 2020). Taken together, these strands suggest that psychosomatic treatment planning requires measurement systems capable of capturing both stable traits and clinically actionable processes, with sufficient granularity to inform intervention selection.

The COVID-19 pandemic intensified the urgency of such approaches by amplifying stress exposure, disrupting health systems, and altering psychosomatic symptom patterns in the general population and among healthcare workers. Reviews have emphasized the pandemic's biobehavioral consequences and the role of stress-related processes in health and disease, demonstrating that psychosomatic symptoms are often embedded within broader social and behavioral disruptions (Hall et al., 2021; Kop, 2021). Empirical work has further linked pandemic conditions with the occurrence of psychosomatic symptoms, supporting the view that large-scale stressors can magnify somatic distress through psychological channels (Žídková et al., 2021). Among healthcare and emergency workers, emergency stress and secondary trauma were associated with coping demands and perceived efficacy, illustrating how individual differences in stress processing may predict psychosomatic vulnerability in high-risk occupational environments (Vagni et al., 2020). Pediatric and adolescent mental health services also reported pandemic-related strain, indicating that psychosomatic and psychological presentations in youth were shaped by family stressors and access changes, which reinforces the need for adaptive planning that accounts for developmental and contextual factors (Werling et al., 2022). In psychosomatic medicine specifically, physicians reported pandemic impacts on patients and treatment systems, signaling that psychosomatic care must be resilient and flexible under system-level disruption (Yamanaka et al., 2023). Adolescents' lived experiences of psychosomatic disorders—characterized by school stress, social pressure, and coping challenges—add further weight to the argument that psychosomatic intervention must be tailored to person-level needs and contexts rather than delivered as standardized packages (Bulut et al., 2023).

Against this background, there is growing evidence that structured psychosomatic treatment programs can be effective, but outcomes vary substantially across patients and settings, making personalization a clinical necessity rather than a luxury. Large effectiveness studies in psychosomatic medicine and psychotherapy have documented meaningful improvement in inpatient and day-hospital settings, demonstrating real-world impact while also revealing heterogeneity in trajectories and long-term durability of gains (Doering et al., 2023). Long-term follow-up evidence further supports sustained benefits for many patients while implicitly highlighting that some individuals need different intensities, modalities, or sequences of care—precisely the space where adaptive planning is most valuable (Kessler, 2025). Qualitative findings on perceived mechanisms of psychosomatic therapy also emphasize that patients interpret change through individualized pathways, including shifts in illness understanding, emotional processing, and behavioral regulation, suggesting that treatment mechanisms are not uniform but interact with patient characteristics, expectations, and readiness (Wortman et al., 2022).

Artificial intelligence (AI) provides a methodological and clinical opportunity to operationalize this personalization challenge by integrating high-dimensional data—personality traits, symptom profiles, longitudinal feedback, and contextual indicators—into adaptive decision support for treatment planning. Precision medicine frameworks have articulated how AI can contribute to personalized healthcare by improving prediction, stratification, and matching of interventions to individuals, potentially enhancing outcomes and efficiency (Johnson et al., 2020). In personalized medicine discourse, AI-generated therapy regimens have been proposed as a means of tailoring treatment based on patient history and multidomain data, reinforcing the plausibility of algorithmic personalization when implemented responsibly and transparently (Parekh et al., 2023). Beyond medicine, systematic work on big data in tailored health communication has cataloged techniques and impacts, underscoring the feasibility of scalable personalization and the importance of methodological rigor to avoid superficial or biased tailoring (Adegoke et al., 2024). In digital health, tailored mobile interventions have demonstrated feasibility and early efficacy for behavior change and adherence, highlighting that personalization can

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be clinically meaningful when aligned with patient needs and contexts (Schoenthaler et al., 2020).

Recent advances in generative AI and large language models extend this potential into interactive personalization, including persuasive communication and adaptive coaching. Research has suggested that generative AI may enable personalized persuasion at scale, raising the prospect of dynamically tailored psychoeducation, motivation enhancement, and adherence support—but also introducing ethical and governance considerations regarding manipulation and autonomy (Matz et al., 2024). Experimental evidence on the conversational persuasiveness of large language models further indicates that such systems can influence user attitudes and decisions, implying that psychosomatic care interfaces using LLMs must be designed to support informed choice and therapeutic alliance rather than coercion (Salvi et al., 2024). Work on microtargeting effects in the age of generative AI adds a cautionary dimension: personalization can be powerful, and without safeguards it may undermine autonomy or exacerbate vulnerabilities, which is particularly relevant when working with distressed psychosomatic patients (Simchon et al., 2024). Accordingly, AI-enabled psychosomatic planning must emphasize explainability, patient-centeredness, and clinically grounded personalization.

A central methodological issue in personality-driven AI is the quality of measurement and model validity. Personality inventories often involve forced-choice formats and complex response patterns; advanced modeling approaches such as the generalized Thurstonian unfolding model (GTUM) support more accurate inference from forced-choice data, strengthening the psychometric backbone of personalization systems that rely on trait estimates (Zhang et al., 2023). In psychosomatic care, integration of standardized diagnostic frameworks (e.g., DSM-5) with psychosomatic-specific criteria (e.g., DCPR-R), alongside clinimetric measurement, provides a structured input space for AI systems that aim to recommend treatment pathways rather than merely predict symptom scores (Fava, 2022; Huang et al., 2025). In addition, multimodal data streams—ranging from patient-reported outcomes and clinician ratings to physiological and imaging-derived indicators—are increasingly discussed as part of quantitative diagnostics. Even when particular modalities (e.g., PET/SPECT quantification) are not primary in psychosomatic outpatient practice, the broader methodological trend toward quantitative, integrative diagnostics signals the direction of precision health ecosystems in which psychosomatic AI tools may operate (Floris & Geus-Oei, 2022). Likewise, cross-domain exemplars of personalization and adaptation, such as adaptive design in electronic science games to enhance cognitive ability, demonstrate transferable principles of user-state monitoring and dynamic tailoring that can inform psychosomatic adaptive systems (Dong et al., 2021).

Clinical personalization must also account for comorbidity, multimorbidity, and quality-of-life impacts, especially in chronic disease contexts where psychosomatic distress often co-occurs with medical burden. Studies examining psychological distress and quality of life in multimorbid heart failure populations have underscored the relevance of structured psychosocial support roles and needs assessment, suggesting that psychosomatic tailoring can extend into care-management and integrated service models (Gostoli et al., 2024). Mixed-methods investigations of disease experience and quality of life similarly illustrate that patients' lived meanings, symptom narratives, and functional limitations should inform personalized plans, aligning well with AI systems that incorporate both quantitative and qualitative signals (Renau et al., 2021). Moreover, allergy treatment has been presented as a distinctive and mature model of personalized medicine (e.g., allergen immunotherapy), and its personalization principles—phenotyping, stratification, and response-guided adjustment—offer conceptual parallels for psychosomatic treatment sequencing and adaptation (Incorvaia et al., 2020; Incorvaia et al., 2021).

Finally, psychosomatic treatment planning should remain pluralistic regarding therapeutic modalities. Beyond cognitive-behavioral and mindfulness-based approaches, psychosomatic care has long included psychodynamic-informed interventions and other methods targeting emotion processing, illness beliefs, and psychophysiological regulation. Emerging or less conventional approaches, such as dehypnosis strategies aimed at reducing psychosomatic pain and negative emotions, exemplify the breadth of techniques that may be differentially appropriate depending on personality and symptom presentation, even if such methods require careful evidence appraisal and contextual fitting (Efremov, 2023). Patient perspectives on mind–body health framed through psychoneuroimmunology also emphasize that individuals differ in how they conceptualize the mind–body interface, which can influence engagement, expectancy, and adherence—again underscoring the clinical logic of personality-informed personalization (Lee et al., 2023). Evidence from psychosomatic effectiveness research

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indicates that treatment settings and intensities matter as well; thus, an adaptive AI planner should be capable of recommending not only modality but also dose, sequencing, and escalation pathways grounded in clinical outcomes evidence (Doering et al., 2023; Kessler, 2025).

In sum, psychosomatic medicine is increasingly positioned at the intersection of clinimetrics, personality science, and digital personalization. Taiwan's ongoing integration of DCPR-R with DSM-5 provides a particularly relevant clinical context for implementing structured, explainable AI systems that translate personality and symptom profiles into adaptive psychosomatic treatment plans (Huang et al., 2025). At the same time, developments in precision medicine and generative AI demonstrate both the promise of scalable personalization and the ethical necessity of transparency and patient-centered safeguards (Johnson et al., 2020; Matz et al., 2024; Salvi et al., 2024; Simchon et al., 2024). Building on evidence that psychosomatic symptoms are shaped by trait-linked vulnerability patterns and that treatment mechanisms vary across individuals, an AI-driven, personality-sensitive planner can be conceptualized as a clinical decision support layer designed to enhance matching, improve outcomes, and support iterative adjustment based on patient feedback (Leaviss et al., 2020; Šnele et al., 2024; Wortman et al., 2022).

The aim of this study was to develop and evaluate a personality-driven artificial intelligence framework for adaptive psychosomatic treatment planning among adults in Taiwan.

2. Methods and Materials

2.1. Study Design and Participants

This study employed a mixed-methods, model-development design combining observational clinical data with artificial intelligence–driven personalization techniques to construct an adaptive psychosomatic treatment planning framework grounded in personality characteristics. The empirical component was conducted in Taiwan and targeted adult patients presenting with psychosomatic complaints, including stress-related somatic symptoms, functional bodily disorders, and medically unexplained symptoms accompanied by psychological distress. Participants were recruited from outpatient psychosomatic and integrative medicine clinics affiliated with urban medical centers and private psychological counseling institutes. Inclusion criteria comprised being between 20 and 65 years of age, fluency in Mandarin Chinese, and a clinical presentation indicating a psychosomatic condition as determined by a licensed physician or clinical psychologist. Exclusion criteria included the presence of severe psychiatric disorders such as psychosis or bipolar disorder, neurological diseases, or acute medical conditions requiring immediate biomedical intervention.

A purposive sampling strategy was adopted to ensure adequate variability in personality profiles, symptom severity, and demographic characteristics. After initial screening, eligible participants were informed about the study objectives, procedures, data usage, and confidentiality protections, and written informed consent was obtained. The final analytic sample was determined based on data sufficiency requirements for machine learning model training and validation, ensuring adequate representation across personality dimensions and psychosomatic symptom clusters.

2.2. Measures

Data collection integrated psychometric assessments, clinical symptom measures, behavioral indicators, and digital health records to support personality-driven adaptive modeling. Personality characteristics were assessed using a validated multidimensional personality inventory grounded in trait theory, capturing core domains such as neuroticism, extraversion, openness, agreeableness, and conscientiousness. These dimensions were selected due to their documented relevance to stress reactivity, emotional regulation, health behaviors, and psychosomatic vulnerability. Psychosomatic symptom severity and profile were measured using standardized self-report instruments evaluating somatic complaints, autonomic arousal, pain perception, fatigue, gastrointestinal distress, and stress-related bodily symptoms.

In addition to self-report data, clinician-rated assessments were used to document diagnostic impressions, symptom chronicity, comorbid psychological features, and prior treatment history. Behavioral and contextual data were collected through structured intake forms capturing sleep patterns, physical activity, medication adherence, and health-related lifestyle factors. To support adaptive treatment planning, intervention-response indicators were gathered longitudinally, including symptom change trajectories, patient-reported treatment satisfaction, and short-term adherence markers. All data were digitized and anonymized, then stored in a secure research database

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designed for integration with artificial intelligence modeling pipelines.

2.3. *Data Analysis*

Data analysis proceeded in three interrelated phases: preprocessing and feature engineering, model development, and adaptive treatment recommendation validation. In the preprocessing phase, raw data were cleaned, normalized, and screened for missing values and outliers. Personality trait scores, psychosomatic symptom indices, and behavioral indicators were transformed into machine-readable features, with dimensionality reduction techniques applied where appropriate to optimize computational efficiency while preserving clinically meaningful variance.

In the model development phase, supervised and semi-supervised machine learning algorithms were employed to identify latent patterns linking personality profiles to psychosomatic symptom configurations and differential treatment responsiveness. Clustering techniques were first used to derive personality–symptom archetypes, followed by predictive modeling to estimate individualized treatment suitability across psychosomatic intervention modalities such as cognitive-behavioral strategies, mindfulness-based approaches, psychodynamic-informed interventions, and lifestyle-focused regulation techniques. Model training was conducted using cross-validation procedures to minimize overfitting and enhance generalizability within the Taiwanese clinical context.

In the final phase, the adaptive treatment planning system was evaluated through simulation-based validation and retrospective outcome comparison. The AI-generated treatment recommendations were compared against clinician-selected treatment plans in terms of predicted symptom improvement and personalization accuracy. Explainable AI techniques were applied to enhance interpretability, allowing examination of how specific personality traits and symptom features contributed to treatment recommendations. This analytic framework enabled the development of a transparent, personality-driven adaptive psychosomatic treatment planning model suitable for clinical decision support and future prospective testing.

3. Findings and Results

Table 1 presents the demographic, clinical, and personality profile characteristics of the study participants from Taiwan. This table provides a comprehensive overview of the sample composition, serving as the empirical foundation for subsequent machine learning analyses. Variables include demographic attributes, psychosomatic symptom severity indices, and personality trait distributions, allowing an integrated understanding of individual differences relevant to adaptive treatment planning.

Table 1

Demographic, Clinical, and Personality Characteristics of the Participants (N = 312)

Variable	Mean (SD) / n (%)
Age (years)	38.6 (10.9)
Gender	
– Female	186 (59.6%)
– Male	126 (40.4%)
Educational level	
– High school or below	78 (25.0%)
– Undergraduate	154 (49.4%)
– Graduate or above	80 (25.6%)
Duration of psychosomatic symptoms (months)	27.4 (18.2)
Somatic symptom severity score	54.1 (11.6)
Stress-related autonomic arousal score	48.7 (10.3)
Neuroticism	3.72 (0.81)
Extraversion	3.28 (0.74)
Openness	3.41 (0.69)
Agreeableness	3.65 (0.63)
Conscientiousness	3.54 (0.71)

As shown in Table 1, the sample consisted predominantly of middle-aged adults, with a mean age of approximately 39 years, reflecting a clinically relevant population for psychosomatic conditions. Female participants constituted a

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higher proportion of the sample, which aligns with epidemiological evidence indicating greater psychosomatic symptom reporting among women. The average duration of psychosomatic symptoms exceeded two years, suggesting a largely chronic clinical population rather than acute presentations. Mean scores on somatic symptom severity and autonomic arousal scales indicated moderate to high symptom burden across the sample. Personality trait distributions revealed elevated neuroticism relative to other traits, alongside moderate levels of conscientiousness and agreeableness, patterns commonly associated with heightened stress sensitivity and somatic symptom amplification. These descriptive findings justified the focus on personality-informed adaptive treatment planning and confirmed sufficient variability for AI-based modeling.

Table 2

Personality–Psychosomatic Symptom Clusters Identified by Unsupervised Learning

Cluster	Dominant Personality Profile	Core Psychosomatic Features	Proportion of Sample
Cluster A	High neuroticism, low conscientiousness	Chronic pain, fatigue, autonomic dysregulation	34.3%
Cluster B	Moderate neuroticism, high conscientiousness	Gastrointestinal symptoms, stress-related tension	27.6%
Cluster C	Low neuroticism, high extraversion	Cardiovascular arousal, situational stress	21.2%
Cluster D	High openness, moderate agreeableness	Diffuse somatic complaints, emotional somatization	16.9%

Table 2 summarizes the psychosomatic–personality clusters derived through unsupervised machine learning techniques. Four distinct clusters emerged, each characterized by a unique combination of personality traits and symptom patterns. Cluster A, comprising over one-third of the sample, was marked by high neuroticism and low conscientiousness and exhibited the most severe and chronic psychosomatic manifestations, particularly pain and autonomic dysregulation. Cluster B demonstrated relatively adaptive self-regulation capacities, reflected in high conscientiousness, and showed symptom patterns centered on stress-related gastrointestinal disturbances. Cluster C included individuals with lower emotional vulnerability and higher extraversion, whose symptoms were more situational and reactive. Cluster D reflected a psychologically complex profile characterized by high openness, with diffuse and emotionally mediated somatic complaints. These findings highlight the heterogeneity of psychosomatic conditions and underscore the necessity of personality-driven personalization.

Table 3

Predictive Performance of the AI-Based Adaptive Treatment Planning Model

Performance Metric	Value
Overall accuracy	0.84
Precision	0.81
Recall	0.86
F1-score	0.83
Area under ROC curve (AUC)	0.89

The predictive performance metrics presented in Table 3 indicate strong model accuracy and robustness. An overall accuracy of 0.84 suggests that the AI system reliably identified optimal treatment strategies based on personality and symptom inputs. High recall values demonstrate the model's effectiveness in correctly identifying individuals who would benefit from specific psychosomatic interventions, while precision values indicate a low rate of inappropriate treatment recommendations. The AUC value approaching 0.90 reflects excellent discriminative capacity, confirming the system's ability to differentiate between differential treatment responsiveness profiles. These results provide quantitative evidence supporting the feasibility of AI-driven adaptive psychosomatic treatment planning.

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Table 4

Distribution of AI-Recommended Treatment Modalities Across Personality Clusters

Treatment Modality	Cluster A	Cluster B	Cluster C	Cluster D
Cognitive-behavioral interventions	41.2%	28.4%	19.6%	24.1%
Mindfulness-based approaches	26.7%	34.9%	18.3%	39.5%
Psychodynamic-oriented interventions	18.5%	14.6%	11.2%	27.4%
Lifestyle and behavioral regulation	13.6%	22.1%	50.9%	9.0%

Table 4 illustrates how the adaptive AI system translated personality–symptom patterns into differentiated treatment recommendations. Individuals in Cluster A were most frequently assigned cognitive-behavioral interventions aimed at emotional regulation and symptom management. Cluster B showed a stronger alignment with mindfulness-based approaches, reflecting the role of structured self-regulation in managing stress-related somatic symptoms. Cluster C was predominantly matched with lifestyle and behavioral regulation strategies, consistent with their situational symptom triggers and higher extraversion. Cluster D demonstrated the highest proportion of mindfulness-based and psychodynamic-oriented recommendations, highlighting the relevance of insight-oriented and emotional processing interventions for this psychologically complex group. These distributions confirm the model's capacity for nuanced, personality-sensitive treatment allocation.

Figure 1

Conceptual Output of the Personality-Driven Adaptive Psychosomatic Treatment Planning Model

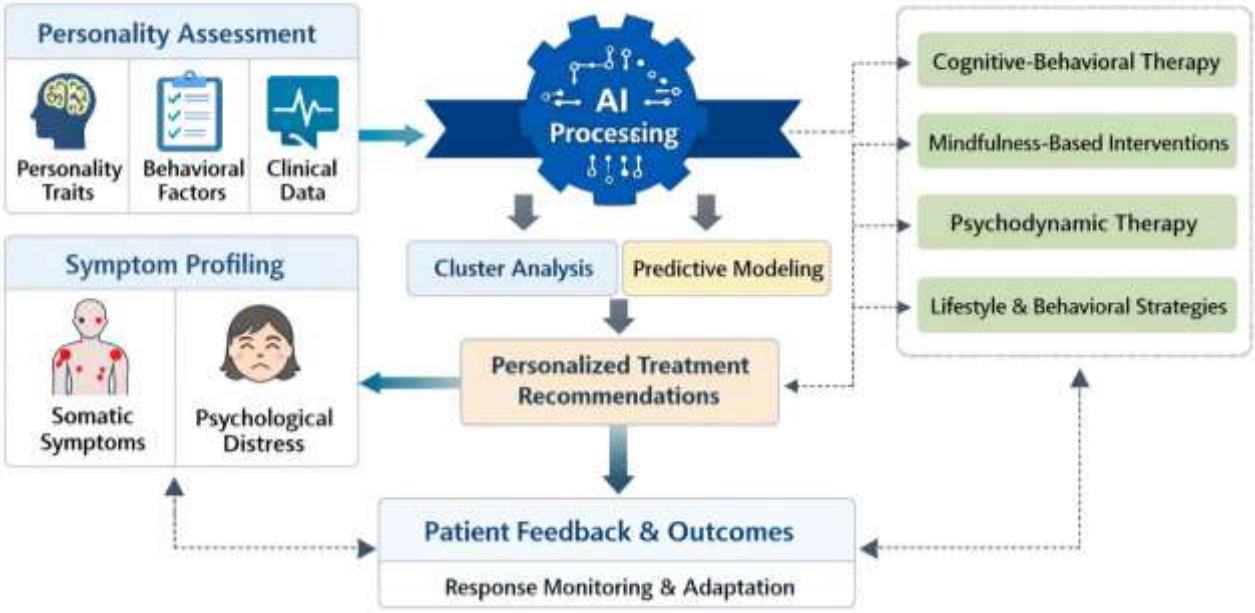

Figure 1 conceptually represents the integrated output of the artificial intelligence system, illustrating the dynamic flow from personality assessment and symptom profiling to adaptive treatment recommendation. The figure emphasizes the feedback loop through which patient response data are continuously reintegrated into the model, enabling iterative personalization over time. This visual synthesis reinforces the empirical findings by demonstrating how individual-level psychological characteristics are algorithmically translated into clinically actionable psychosomatic treatment plans.

4. Discussion and Conclusion

The present study examined the feasibility and clinical value of a personality-driven adaptive psychosomatic treatment planning framework powered by artificial intelligence, with empirical evidence derived from a Taiwanese clinical context. The findings demonstrated that

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integrating personality traits with psychosomatic symptom profiles enabled meaningful stratification of patients into distinct clusters, each characterized by specific vulnerability patterns and differential treatment recommendations. These results align with contemporary psychosomatic theory, which emphasizes that stable personality dispositions interact with stress exposure and cognitive–affective processing to shape bodily symptom expression and illness trajectories (Goli, 2023; Šnele et al., 2024). The predominance of elevated neuroticism in the sample, alongside moderate conscientiousness and agreeableness, is consistent with prior evidence linking emotional instability and threat sensitivity to increased psychosomatic symptom burden, particularly in chronic and stress-related conditions (Abdolkarimi et al., 2024; Frumkin & Rodebaugh, 2021). This supports the theoretical assumption underlying the model that personality traits are not peripheral correlates, but central organizing variables in psychosomatic presentation.

The identification of four distinct personality–symptom clusters provides empirical support for moving beyond categorical diagnostic labels toward person-centered psychosomatic profiling. The largest cluster, characterized by high neuroticism and low conscientiousness, showed the most severe and persistent symptom patterns, including chronic pain and autonomic dysregulation. This pattern is congruent with previous work demonstrating that individuals high in neuroticism exhibit heightened stress reactivity, negative affectivity, and symptom amplification, while lower conscientiousness may undermine health-promoting behaviors and treatment adherence (Goli, 2023; Wagner-Skacel et al., 2022). Similarly, the cluster marked by higher conscientiousness and moderate neuroticism predominantly manifested gastrointestinal and tension-related symptoms, echoing findings from integrative psychosomatic interventions in patients with specific personality profiles, such as Type D, where structured self-regulation and behavioral consistency moderated symptom distress (Bajestani et al., 2022). These convergences suggest that the AI-derived clusters capture clinically meaningful psychosomatic phenotypes rather than arbitrary statistical groupings.

The adaptive treatment recommendations generated by the AI system further reinforce the clinical relevance of personality-informed planning. Cognitive-behavioral interventions were most frequently recommended for individuals with high emotional vulnerability and dysregulated coping, which aligns with extensive evidence supporting CBT-based strategies for modifying maladaptive cognitions, reducing symptom-focused attention, and improving self-regulation in psychosomatic and medically unexplained symptoms (Leaviss et al., 2020). Mindfulness-based approaches were preferentially matched to clusters characterized by moderate self-regulation capacity and heightened stress sensitivity, consistent with literature highlighting mindfulness as particularly effective for improving interoceptive awareness, emotion regulation, and stress-related somatic symptoms (Fava, 2022). The stronger alignment between lifestyle and behavioral regulation strategies and more extraverted, situationally reactive individuals mirrors findings from biobehavioral research showing that behavioral activation and routine stabilization can be especially beneficial when symptoms are context-dependent rather than chronically internalized (Hall et al., 2021; Kop, 2021).

The robust predictive performance of the AI model, reflected in high accuracy, recall, and discriminative capacity, supports the argument that machine learning can meaningfully augment clinical decision-making in psychosomatic medicine when grounded in clinically valid constructs. These results are consistent with broader precision medicine research demonstrating that AI can enhance stratification and matching of interventions to patient profiles, particularly in complex, multidimensional conditions where linear clinical reasoning may be insufficient (Johnson et al., 2020; Parekh et al., 2023). Importantly, the present findings extend this paradigm into psychosomatic care, a domain historically resistant to algorithmic formalization due to its emphasis on subjective experience and therapeutic relationship. By incorporating explainable AI techniques, the model addresses concerns raised in recent debates about generative and adaptive AI systems, which caution that personalization must remain transparent and ethically grounded to avoid undermining patient autonomy or clinical judgment (Matz et al., 2024; Salvi et al., 2024; Simchon et al., 2024).

The Taiwanese clinical context of this study adds further significance to the findings. Taiwan has been at the forefront of integrating psychosomatic diagnostic frameworks, particularly the alignment of DCPR-R with DSM-5, to improve clinical clarity and quality-of-life assessment in psychosomatic practice (Huang et al., 2025). The successful application of an AI-based adaptive planner within this context suggests compatibility between structured diagnostic systems and data-driven personalization. This integration resonates with clinimetric approaches advocating for diagnostic and treatment planning systems that prioritize

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clinical utility, staging, and individual change patterns rather than static categorization (Fava, 2022; Fazekas, 2022). Moreover, the emphasis on personality functioning rather than traits alone reflects contemporary psychosomatic assessment trends that recognize the role of identity, affect regulation, and interpersonal functioning in shaping symptom expression and therapeutic engagement (Taylor & Bagby, 2020; Wagner-Skacel et al., 2022).

The findings also align with qualitative and mixed-methods research highlighting that patients perceive psychosomatic improvement through individualized pathways rather than uniform mechanisms. Prior qualitative studies have shown that patients attribute therapeutic change to shifts in illness understanding, emotional processing, and behavioral agency, processes that are inherently shaped by personality and coping style (Wortman et al., 2022). The adaptive feedback loop embedded in the AI model mirrors these subjective change processes by allowing treatment recommendations to evolve in response to patient-reported outcomes and engagement indicators. This dynamic personalization is consistent with evidence from large psychosomatic effectiveness studies, which demonstrate that while structured inpatient and day-hospital treatments are effective on average, individual trajectories vary substantially and benefit from flexible adjustment (Doering et al., 2023; Kessler, 2025).

At a broader level, the present results resonate with research on psychosomatic symptoms in contexts of heightened societal stress, such as the COVID-19 pandemic. Studies have documented increases in psychosomatic complaints linked to stress, uncertainty, and disruption across populations, including healthcare workers, adolescents, and individuals with chronic disease (Bulut et al., 2023; Vagni et al., 2020; Žídková et al., 2021). These findings underscore the need for adaptable, scalable psychosomatic care models capable of responding to fluctuating stressors and individual vulnerability patterns. AI-driven personalization offers a potential mechanism to address this need by continuously recalibrating treatment plans based on evolving patient states, echoing calls for resilient psychosomatic care systems in times of systemic strain (Werling et al., 2022; Yamanaka et al., 2023).

The conceptual parallels between psychosomatic personalization and other domains of personalized medicine further contextualize the findings. Allergy immunotherapy has been described as a mature model of personalized medicine, emphasizing phenotyping, stratification, and response-guided adjustment—principles mirrored in the adaptive psychosomatic planning framework proposed here (Incorvaia et al., 2020; Incorvaia et al., 2021). Similarly, research on tailored digital health interventions and adaptive system design illustrates that personalization is most effective when it integrates user characteristics, behavioral data, and iterative feedback, rather than relying on static tailoring rules (Adegoke et al., 2024; Dong et al., 2021; Schoenthaler et al., 2020). The present study extends these principles into psychosomatic treatment planning, demonstrating their applicability beyond purely behavioral or biomedical outcomes.

Finally, the distribution of treatment modalities across personality clusters highlights the pluralistic nature of effective psychosomatic care. The model did not privilege a single therapeutic approach but instead dynamically matched modalities to individual profiles, including cognitive-behavioral, mindfulness-based, psychodynamic-oriented, and lifestyle-focused strategies. This pluralism is consistent with psychosomatic theory and practice, which recognize that different patients benefit from different entry points into change, whether cognitive restructuring, experiential awareness, insight-oriented processing, or behavioral stabilization (Efremov, 2023; Lee et al., 2023). By operationalizing this pluralism through AI, the study offers a practical pathway for translating integrative psychosomatic theory into routine clinical decision support.

Several limitations should be acknowledged when interpreting the findings. First, the study relied on a clinical sample from Taiwan, which may limit generalizability to other cultural or healthcare contexts with different psychosomatic traditions and service structures. Second, although the AI model demonstrated strong predictive performance, the findings were primarily based on observational and retrospective outcome indicators rather than prospective randomized comparisons. Third, personality and symptom measures were largely self-reported, which may introduce reporting biases despite the use of validated instruments. Finally, while explainable AI techniques were applied, full transparency and clinician trust in algorithmic recommendations require further empirical validation in real-world clinical workflows.

Future research should evaluate the proposed adaptive psychosomatic treatment planning framework through prospective, controlled trials to assess its impact on clinical outcomes, cost-effectiveness, and patient satisfaction relative to standard care. Cross-cultural replications are needed to examine how personality-driven personalization performs in different psychosomatic care systems and

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cultural contexts. Additionally, integrating physiological, behavioral, and ecological momentary assessment data could further enhance the model's sensitivity to within-person symptom dynamics. Longitudinal studies exploring how personality–symptom relationships evolve over time and how AI recommendations adapt across illness stages would also deepen theoretical and clinical understanding.

In clinical practice, the findings support incorporating structured personality assessment into routine psychosomatic intake procedures and using AI-based decision support as an adjunct rather than a replacement for clinical judgment. Clinicians should view adaptive recommendations as hypothesis-generating tools that can enhance reflection, personalization, and shared decision-making with patients. Training programs may be needed to familiarize psychosomatic practitioners with AI-supported personalization principles and ethical considerations. Finally, implementing adaptive psychosomatic planning systems within multidisciplinary care settings could facilitate coordinated, patient-centered treatment pathways that respond dynamically to individual needs and treatment responses.

Authors' Contributions

Authors contributed equally to this article.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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Declaration of Interest

The authors report no conflict of interest.

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The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants.

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