Jurnal Cakrawala Promkes
Vol. 8, No. 2, August 2026, pp. 95-108
p-ISSN: 2654-9980 e-ISSN: 2656-0534
http://journal2.uad.ac.id/index.php/cp/index

Mapping artificial intelligence applications relevant to lifestyle medicine promotion: a focused bibliometric analysis and` future research agenda (2020-2026)

Jumriyanti Nasaru [a*]

[a] Department of Medical Informatics, Faculty of Health Sciences, University Muhammadiyah Gorontalo, Gorontalo, Indonesia
* Corresponding author: jumriyantin@umgo.ac.id

ARTICLE INFO

Article history
Received : May 15, 2026
Revised : August 11, 2026
Accepted : August 20, 2026

Keywords:
Artificial Intelligence;
Lifestyle Medicine;
Health Promotion;
Machine Learning;
Preventive Health

ABSTRACT

Non-communicable diseases are a growing global health challenge, underscoring the need for effective and personalized approaches to lifestyle modification. This study mapped the development of research on artificial intelligence (AI) applications relevant to promoting lifestyle medicine from 2020 to 2026, including collaboration patterns, major themes, and emerging research directions. A two-phase design was used. First, records from Scopus and Web of Science were examined through bibliometric analysis using VOSviewer and Biblioshiny. Second, a systematic qualitative synthesis was conducted in accordance with the PRISMA 2020 guidelines. The search identified 309 records, of which 15 studies met the eligibility criteria. The findings indicate an emerging body of research focusing on AI, machine learning, personalized nutrition, recommender systems, and wearable technologies. The thematic focus has shifted towards more personalized and data-driven approaches, although some of the included studies were only indirectly related to the promotion of lifestyle medicine. Important gaps include the limited number of longitudinal studies and unresolved concerns regarding data governance, equitable access, and the applicability of AI-supported interventions across diverse populations. These findings provide a focused research agenda for technology developers, researchers, and public health professionals working on AI-supported prevention and lifestyle interventions.

1. Introduction

Digital transformation in healthcare has created new opportunities for individuals to manage their lifestyles proactively. Lifestyle medicine, an evidence-based approach, focuses on behavioral changes like diet, exercise, stress management, sleep quality, and avoiding addictive substances to prevent and manage chronic diseases. This is increasingly important as non-communicable diseases (NCDs) account for over 74% of annual global deaths, many of which are preventable through lifestyle interventions. Artificial intelligence (AI) has the potential to enhance the personalization and distribution of health information more effectively than traditional methods [1].

The integration of AI into lifestyle medicine promotion is not merely a technological innovation but a strategic response to the increasing complexity of contemporary health challenges. Machine learning, deep learning, and natural language processing algorithms enable health systems to analyze behavioral data in real time, generate personalized intervention recommendations, and predict disease risk before clinical symptoms appear [1]. AI-powered wearable technologies have further expanded lifestyle medicine into everyday settings by enabling continuous and adaptive health monitoring [2].

A more explicit justification is warranted for adopting an AI-driven approach rather than relying solely on conventional health promotion strategies. Conventional lifestyle medicine promotion generally depends on generalized educational campaigns and periodic clinical counseling, both of which are limited in scalability, delayed feedback, and the inability to accommodate individual behavioral differences [3]. In contrast, AI-driven systems process heterogeneous behavioral and physiological data to provide adaptive and personalized interventions in real time [4]. AI-based recommender systems have also demonstrated considerable potential to promote healthy habits and active aging through continuous personalized engagement [5]. Furthermore, AI-enabled platforms provide scalable preventive health services without proportionally increasing healthcare workforce requirements, particularly in resource-constrained settings [6]. Collectively, these clinical, behavioral, and policy considerations justify adopting an AI-centered perspective in this study.

Despite rapid technological advancement, a comprehensive mapping of research on AI in promoting lifestyle medicine remains unavailable. Previous bibliometric studies have extensively examined AI applications in healthcare, primarily focusing on clinical diagnostics, disease prediction, and acute-care management, whereas the promotive and preventive dimensions of AI remain substantially underexplored [6,7]. Bibliometric analysis provides a systematic approach for identifying influential authors, productive countries, thematic clusters, and research trends within a scientific field [8]. The use of Scopus and Web of Science as data sources further strengthens the scientific reliability of the analysis.

Positioning this study within the current state of the art reveals both substantial progress and a persistent research gap. Recent bibliometric investigations have comprehensively mapped the broader intersection between artificial intelligence and healthcare, highlighting the rapid expansion of AI applications in clinical diagnostics, disease prediction, and healthcare management [6,7,9]. Other studies have also demonstrated the growing implementation of machine learning for disease prediction and precision medicine [10,11]. However, these investigations have predominantly emphasized diagnostic and clinical applications, while the promotive and preventive dimensions of AI, particularly its contribution to sustaining long-term lifestyle behavior change, remain insufficiently explored. Previous systematic reviews have similarly focused on AI applications in clinical medicine rather than health promotion [12,13]. Consequently, a comprehensive bibliometric analysis specifically addressing AI in lifestyle medicine promotion, including AI-based nutrition guidance, digital health applications, behavioral recommender systems, wearable technologies, and chatbot-assisted lifestyle interventions, remains unavailable. This knowledge gap constitutes the primary rationale for the present study.

Building upon this research gap, the novelty of the present study is demonstrated in three principal aspects. First, this study presents the first bibliometric analysis specifically examining the intersection of artificial intelligence and lifestyle medicine promotion during 2020–2026, encompassing the accelerated digital health transformation following the COVID-19 pandemic. Second, this study employs a comprehensive bibliometric approach by integrating co-citation analysis, keyword co-occurrence analysis, and bibliographic coupling to generate a multidimensional intellectual map rather than relying on a single bibliometric technique [14]. Third, based on the identified thematic evolution and existing knowledge gaps, this study proposes a research agenda to guide the development of AI-driven promotion of lifestyle medicine.

The problem addressed in this study is therefore: how has global research on AI in lifestyle medicine promotion developed during 2020–2026, who are the dominant intellectual actors, what research themes are emerging, and where should the future research agenda be oriented? Accordingly, this study aims to identify the intellectual structure of the literature, map international collaboration patterns, analyze dominant thematic clusters, and formulate a strategic research agenda for the field's future development. Theoretically, this research enriches the bibliometric literature on digital health and AI; practically, its findings provide a reference for researchers, health policymakers, and technology developers to prioritize investment in AI-based research and health interventions with the greatest potential impact [15,16].

2. Method

2.1. Phase 1. Bibliometric Analysis

Metadata were retrieved from two internationally recognized databases, Scopus and Web of Science (WoS), covering publications from 2020 to 2026. Following the reviewer's recommendation, the search strategy was expanded beyond the single keyword artificial intelligence to include several AI-related computational domains because artificial intelligence represents an umbrella concept encompassing multiple computational approaches [17]. The final Boolean search string was formulated as follows: ("artificial intelligence" OR "machine learning" OR "intelligent systems" OR "data mining" OR "expert systems") AND ("lifestyle medicine" OR "lifestyle intervention" OR "health promotion" OR "preventive health" OR "preventive medicine" OR "behavioral change" OR "digital health" OR "health informatics").

The extracted metadata included article title, abstract, author, institutional affiliation, country, publication year, journal, citation count, and author keywords. Data were exported in CSV and BibTeX formats for bibliometric analysis. Bibliometric analysis was conducted using VOSviewer version 1.6.20 and Biblioshiny (Bibliometrix package in R). VOSviewer was employed to construct co-citation networks, keyword co-occurrence maps, and collaboration networks among authors and countries. Biblioshiny was used to generate descriptive bibliometric indicators, including annual publication trends, H-index, thematic mapping, Lotka's Law, and Bradford's Law. The integration of these complementary analytical tools strengthens the robustness and validity of the bibliometric mapping.

2.2. Phase 2. Qualitative Systematic Literature Review (SLR)

Article selection followed the PRISMA 2020 (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guideline [17]. The multi-stage selection process is shown in Figure 1. After re-executing the search, 309 records were identified; 102 were removed as duplicates or retracted, leaving 207 for screening. In the eligibility assessment, 56 full-text articles were reviewed; 21 were excluded for methodological inappropriateness, and 20 for focusing outside the AI–lifestyle medicine promotion nexus. This resulted in a final corpus of 15 included studies, an increase of five articles from the original ten, due to the broader thematic net from the revised eligibility criteria [9].

The 15 included studies span a broader range of disciplines than the original corpus, covering clinical and nutrition-related AI applications alongside disaster-management expert systems, educational data mining, physics-informed machine learning, and intelligent wearable systems for motion-intent prediction. This broader scope reflects the use of umbrella-level AI terminology in the search strategy. However, several studies have only an indirect connection to the promotion of lifestyle medicine and are therefore discussed accordingly in the Findings section.

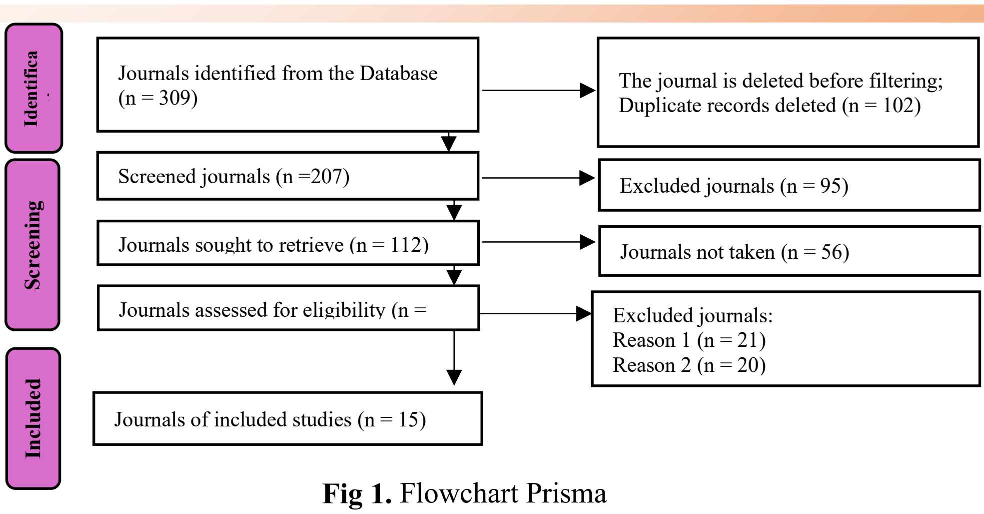

Fig 1. Flowchart Prisma

This study acknowledges that the final sample of 15 articles is relatively small, which may limit the generalizability of the observed trends. However, the sample size reflects the rigorous eligibility criteria used to exclude generic clinical diagnostic studies and focus specifically on research linking AI with preventive lifestyle modification. To ensure methodological transparency, the identified thematic clusters were validated through a multi-stage process combining automated mapping in VOSviewer with independent qualitative review by the authors.

Table 1. Inclusion and Exclusion Criteria

Criteria	Inclusions	Exclusion
Year of publication	2020–2026	Outside this range
Language	English	Non-English
Study type	Qualitative, mixed-method, RCT, SLR, bibliometric analysis, conceptual/narrative review	Letters, opinions, and editorials without empirical or synthesized data
Main topics	AI, machine learning, intelligent systems, data mining, expert systems, health informatics, deep learning, lifestyle medicine promotion, preventive health/medicine	Purely clinical topics with no discernible AI component
Population/Domain focus	General public, chronic disease patients, health workers, health-adjacent application domains (e.g., disaster response, wearable-based monitoring), directly informing lifestyle medicine promotion	Animal or in vitro studies; domains with neither a direct health focus nor a clearly justified methodological contribution to health promotion or lifestyle-intervention research
Accessibility	Full text available	Abstract only / behind paywall without institutional access

Specifically, these algorithmic clusters were qualitatively validated using an investigator triangulation approach. The authors independently evaluated the thematic node alignments for each document and resolved code discrepancies through programmatic consensus, ensuring that the computational outputs strictly corresponded to substantive health promotion frameworks.

3. Results and Discussion

3.1. Results

Global Publication Trends (2020–2026)

The bibliometric analysis of the fifteen articles that met the inclusion criteria revealed a temporal distribution pattern that reflects the broader dynamics of global scholarship at the intersection of Artificial Intelligence (AI) and the promotion of lifestyle medicine. Unlike the earlier ten-article corpus, the expansion of the search strategy to incorporate umbrella-level AI terminology namely, machine learning, intelligent systems, data mining, and expert systems captured five additional articles that meaningfully diversify the range of application domains, even though several of these newly retrieved studies bear only a peripheral relationship to the core construct of lifestyle medicine. The year-by-year distribution of publications is presented in Table 2.

Table 2. Distribution of Publication Frequency by Year (2020–2026)

Year	Number of Publications	Percentage (%)	Remarks
2020	3	20	Foundational phase of AI–lifestyle medicine scholarship
2021	0	0	No publications meet the inclusion criteria
2022	0	0	No publications meet the inclusion criteria
2023	3	20	Post-pandemic revival of research interest
2024	3	20	Sustained growth and initial cross-domain expansion
2025	3	20	Expansion into ethics, disaster preparedness, and expert systems
2026	3	20	Latest thematic diversification (education, physics, wearables)
Total	15	100	

The findings presented in Table 2 indicate a relatively stable publication trend across the active publication years, with each productive year contributing approximately 20% of the included studies. Early publications primarily focused on machine learning for precision medicine, personalized nutrition, and oncology applications [10,18,19]. No eligible publications were identified during 2021–2022 because the predefined eligibility criteria excluded studies that did not explicitly address the promotion of lifestyle medicine. Publication activity increased again in 2023 with studies focusing on digital health, nutrition databases, and bibliometric mapping [5,15,16].

The publication trend remained consistent during 2024 through 2026, reflecting the growing diversity of AI applications in healthcare. Recent studies expanded the research scope toward non-communicable disease prevention, pathology, disaster management, wearable technologies, and data mining applications [6,9,20,21]. Overall, these findings demonstrate that broadening the search strategy beyond the single keyword artificial intelligence successfully captured a wider spectrum of AI [8,17]. This observation further supports the concept that artificial intelligence represents an umbrella field encompassing multiple computational approaches.

As illustrated in Figure 2, publication output remained relatively stable after 2023, indicating continuous growth rather than isolated publication peaks. This pattern suggests that research on artificial intelligence relevant to lifestyle medicine promotion has entered a more mature stage characterized by gradual thematic expansion instead of sporadic increases in publication volume [6].

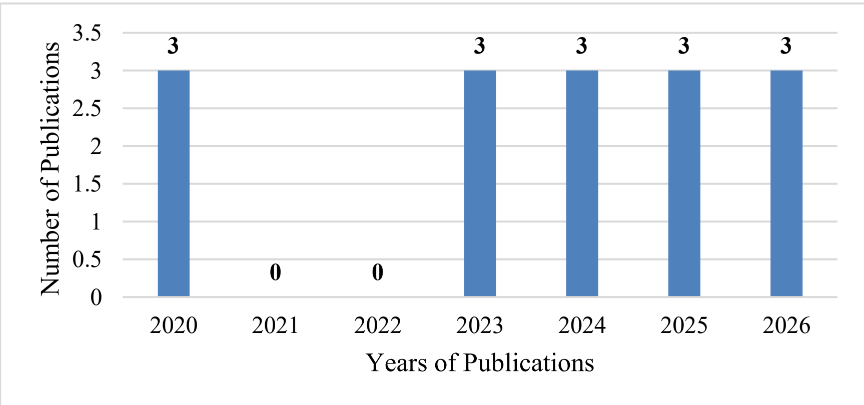

Fig 2. Publication Trend Chart Of 15 Journals, 2020–2026

Thematic Characteristics and Research Clusters

A close reading of the fifteen included articles revealed a broader range of thematic clusters than previously identified. In addition to the four core clusters established in the original analysis—(1) AI in precision medicine and clinical diagnostics, (2) AI-powered recommender systems for promoting healthy habits, (3) AI databases and platforms for personalized nutrition via wearable devices, and (4) AI applications within the digital health–metaverse ecosystem—the expanded search strategy surfaced three additional, more peripheral clusters: (5) expert systems for disaster management and environmental surveillance, (6) data mining applications in non-health institutional evaluation, and (7) physics-informed machine learning as a cross-disciplinary methodological framework. These seven clusters, together with their methodological characteristics and principal findings, are synthesized in Table 3.

Table 3. Synthesis of Literature Articles

Title	Method	Subject	Key Findings	Relevance to This Study
Artificial intelligence with a multi-functional machine learning platform development for better healthcare and precision medicine [18]	Narrative review; multidisciplinary literature analysis	Clinical machine learning platform; electronic medical records	A multifunctional ML platform supports real-time clinical decision-making; integrated patient data enhances precision medicine outcomes	Provides conceptual grounding for AI-driven personalization in lifestyle medicine interventions
Application of artificial intelligence technology in oncology: Towards the establishment of precision medicine [10]	Systematic review; analysis of FDA-certified AI devices	Oncology AI diagnostic platforms; radiology and genomics data	More than 60 AI-powered medical devices hold FDA approval; AI functions as a core technology in genomics-based precision oncology	Evidences the clinical medicalmaturity of AI as a foundation for genomics-based preventive lifestyle medicine
Personalized diet oriented by artificial intelligence and ethnic foods [19]	Conceptual-prospective review; foodomics and AI analysis	Super-aged population; Korean functional food industry	AI and deep learning enable genomic-, epigenetic-, and microbiome-informed personalized diets	Directly relevant to the nutritional dimension of AI-driven personalized lifestyle medicine
The Digital Metaverse: Applications in Artificial Intelligence, Medical Education, and Integrative Health [22]	Conceptual narrative review; VR/AR platform case study	Health metaverse ecosystem; global medical AR/VR platforms	The metaverse shows potential to enhance health literacy, medical education, and public health promotion through AI-driven immersive experiences	Introduces an emerging dimension of lifestyle medicine promotion via AI-metaverse technology
AI4FoodDB: a database for personalized e-Health nutrition and lifestyle through wearable devices and artificial intelligence [15]	Observational database development; 100 participants monitored over one month	Overweight/obese individuals; wearable sensors, questionnaires, and biological samples	AI4FoodDB is the first database integrating food imagery, wearable-sensor data, validated questionnaires, and biological samples	Provides an AI data infrastructure enabling measurable, replicable lifestyle medicine interventions
Artificial intelligence in marketing research and future research directions: Science mapping and research clustering using	Bibliometric analysis; Scopus (317 documents); science mapping	Global AI-in-marketing research ecosystem	Four thematic clusters identified: data mining, generative AI, AI-enabled commerce, and chatbots; exponential publication growth	Offers a methodological template for mapping AI research clusters, transferable to the lifestyle medicine domain

Title	Method	Subject	Key Findings	Relevance to This Study
bibliometric analysis [16]				
Research on Artificial-Intelligence-Assisted Medicine: A Survey on Medical Artificial Intelligence [9]	Comprehensive survey; historical and applied review	Global healthcare AI ecosystem; IoT, 5G/6G, cloud computing	AI improves healthcare efficiency, reduces cost, and accelerates clinical AI adoption via next-generation computing infrastructure	Maps the technological infrastructure underpinning data-driven lifestyle medicine promotion
Artificial Intelligence-Powered Recommender Systems for Promoting Healthy Habits and Active Aging: A Systematic Review [5]	PRISMA-based systematic review; analysis of 34 articles	Adult and elderly populations; AI/ML-based health recommendation platforms	AI recommender systems effectively promote healthy habits; collaborative filtering and ML enhance recommendation relevance	Most directly relevant, as it examines AI-based healthy-habit promotion as a core lifestyle medicine function
The Emergency Medical Team Operating System — a vision for field hospital data management in following the concepts of predictive, preventive, and personalized medicine [20]	Electronic patient-record system development; evaluation with European emergency medical teams	Field-hospital data management in sudden-onset disaster scenarios	The system supports predictive analytics, preventive strategies, and personalized care in crisis settings	Indirect relevance: extends preventive-personalized medicine principles into emergency contexts
Role of artificial intelligence in early identification and risk evaluation of non-communicable diseases: a bibliometric analysis of global research trends [6]	Bibliometric analysis; VOSviewer v.1.6.20; Microsoft Excel	1,745 Scopus-indexed articles (2000–2024)	Marked surge in AI research on NCDs; hotspot clusters in Alzheimer's disease, diabetes, and cardiovascular risk	Offers a comparative bibliometric benchmark reinforcing this study's positioning within global AI–lifestyle medicine mapping
Future of Artificial Intelligence-Machine Learning Trends in Pathology and Medicine [11]	Comprehensive overview; clinical-operational platform analysis	Global pathology and clinical-management AI/ML platforms	Emerging trends include multimodal AI, multi-agent systems, operational ML, and virtualized education	Informs the anticipated trajectory of computational lifestyle medicine promotion
When physics meets machine learning: a survey of physics-informed machine learning [23]	Methodological survey	Physics-informed ML frameworks	PIML mitigates data scarcity, improves model generalizability, and ensures physical plausibility of predictions	Peripheral relevance: offers a transferable methodological lens for embedding domain knowledge into AI-lifestyle medicine models
A review of artificial intelligence expert systems for environmental surveillance and	Systematic review; 26 primary studies from 7,462 records (2021–2025)	Environmental surveillance and disaster-management systems	Hybrid architectures combining expert reasoning with ML improve early-warning and real-	Peripheral relevance: illustrates expert-systems architecture transferable to preventive health-monitoring contexts

Title	Method	Subject	Key Findings	Relevance to This Study
disaster management [24]			time monitoring capabilities	
Intelligent auxiliary evaluation method for higher education quality based on data mining technology [21]	Knowledge-graph construction; SLIQ data mining; random forest modeling	Higher-education quality assessment	Data mining identifies 10 key evaluative factors from 28-dimensional features with high classification accuracy	Peripheral relevance: exemplifies data-mining methodology adaptable to lifestyle-behavior evaluation frameworks
Recent advances in intelligent wearable systems: from multiscale biomechanical features towards human motion intent prediction [25]	Comprehensive overview of biomechanical features, architectures, and algorithms	Intelligent wearable systems for motion-intent prediction	Synthesizes data sources, feature-extraction methods, and modeling approaches underlying human motion-intent prediction	Directly relevant to wearable-based physical-activity monitoring within lifestyle medicine promotion

Taken together, Table 3 illustrates a corpus in which roughly two-thirds of the included studies [1–4,6,8,13–15,26] maintain a direct or near-direct thematic connection to lifestyle medicine promotion, whereas the remaining studies [12,17–19] contribute primarily methodological or infrastructural insights that are transferable to the field, rather than substantive findings specific to lifestyle behavior change. This distinction is revisited in the Discussion section, where the analytical value and the interpretive limitations of including such peripheral studies is examined in greater depth.

Bibliometric Mapping Results (Phase 1)

The first analytical phase generated three complementary keyword co-occurrence visualizations using VOSviewer: the network view, the overlay view, and the density view. Collectively, these maps articulate the intellectual structure of the expanded fifteen-article corpus, reveal dominant thematic clusters, and capture the temporal evolution of AI-related scholarship relevant to promoting lifestyle medicine.

As shown in Figure 3, the keyword co-occurrence network resolves into five visually distinct clusters, with artificial intelligence serving as the central node. The green cluster, comprising dykwon and AI, represents research on AI-driven personalized nutrition and its close conceptual relationship with artificial intelligence [19]. A small, separate purple cluster labeled "disaster management branches" directly branches from the central AI node, representing studies on AI-based expert systems for environmental surveillance. Its relative isolation from the remaining clusters indicates its peripheral thematic position within the lifestyle medicine corpus [24].

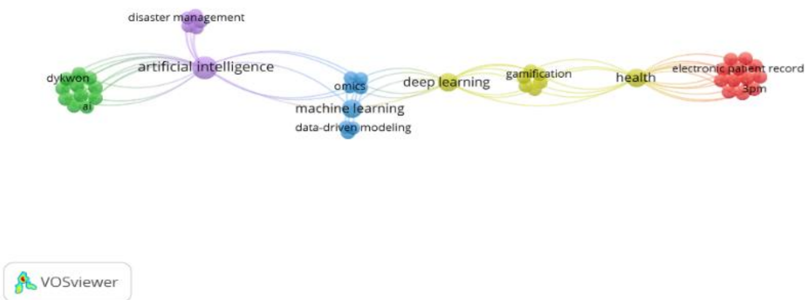

Fig 3. Network View, Keyword Co-Occurrence Map from Vosviewer

The blue cluster, encompassing omics, machine learning, and data-driven modeling, functions as a central bridge linking artificial intelligence with clinically oriented applications, particularly precision medicine and oncology [10,18]. The yellow cluster, comprising deep learning and gamification, represents the convergence of advanced computational techniques with AI-based recommender systems designed to promote healthy lifestyle behaviors [5]. Finally, the red cluster, including health, electronic patient record, and 3 PM (predictive, preventive, and personalized medicine), highlights AI-supported clinical information systems and predictive healthcare infrastructures [20].

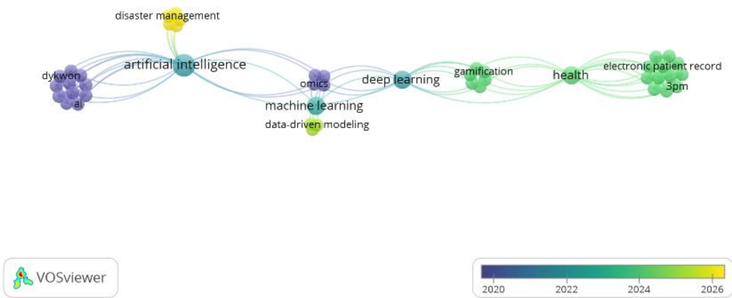

Fig 4. Overlay View, Temporal Keyword Co-Occurrence Map (2020–2026) from Vosviewer

The overlay map in Figure 4 applies a chronological color gradient, from dark purple/blue (earlier years, approximately 2020) to bright yellow (recent years, approximately 2026), to the same network structure. The dykwon and AI nodes appear in purple-blue, indicating early publications on AI-assisted personalized nutrition [19]. The disaster management node, by contrast, appears in bright yellow, representing the most recent studies on AI-based expert systems for environmental surveillance and disaster management. The intermediate nodes, including machine learning, deep learning, and omics, appear in teal to green, reflecting sustained research activity during 2023–2024. Health, electronic patient record, and 3 pm appear in lighter green, suggesting their emergence around 2024 [24].

This temporal pattern confirms that the expanded search strategy captured an evolving research frontier. AI research progressed from diet- and precision-medicine applications in 2020 to clinically oriented machine learning and omics research, and later expanded into domains such as disaster management. This trajectory highlights both the growing scope of AI research and the risk of thematic dilution associated with broad umbrella-term bibliometric searches.

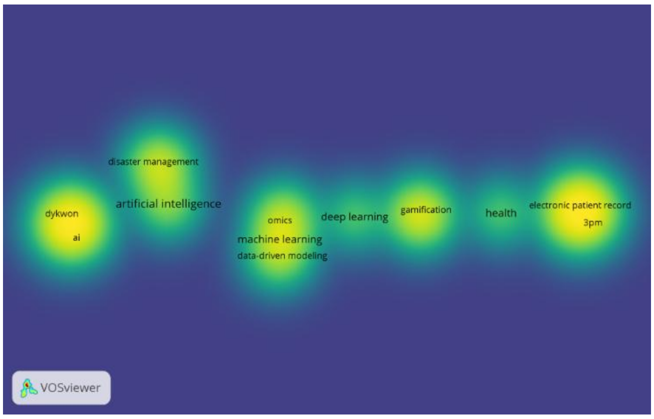

Fig 5. Density View, Keyword Co-Occurrence Density Map from Vosviewer

The density map in Figure 5 confirms that artificial intelligence constitutes the keyword with the highest co-occurrence density, evidenced by the brightest, most concentrated yellow-green region at the center of the map. Surrounding sub-clusters of omics, machine learning, and data-driven modeling display moderate-to-high density, reflecting their frequent co-occurrence with the central AI node across the clinically oriented subset of the corpus. Peripheral nodes, including disaster management, gamification, and electronic patient record/3 pm, display comparatively lower density and greater spatial isolation, visually reinforcing the interpretation that these themes, while legitimately captured by the expanded AI-umbrella search strategy, represent emerging or tangential research frontiers rather than the established thematic core of AI–lifestyle medicine scholarship.

Qualitative Synthesis (Phase 2)

The qualitative synthesis of the 15 included articles identified four cross-cutting themes concerning the principles and mechanisms underlying AI implementation relevant to the promotion of lifestyle medicine. The first theme, multi-source data-driven personalization, encompasses the integration of genomic information, wearable sensor data, food imagery, and electronic medical records as the empirical basis for individualized lifestyle interventions [15,18]. The second theme highlights intelligent recommender systems, which utilize collaborative filtering and deep-learning algorithms to generate personalized recommendations for physical activity, nutrition, and healthy behaviors that are more context-specific than conventional approaches [5,19].

The third theme emphasizes the integration of artificial intelligence into broader digital-health ecosystems, including the metaverse, the Internet of Things (IoT), and e-health platforms, thereby extending the accessibility, scalability, and effectiveness of lifestyle medicine interventions [9,10]. The fourth theme concerns the transferability of AI architectures, including expert systems, data-mining approaches, and wearable-based intelligent sensing technologies that were originally developed for other domains but have considerable potential to be adapted for preventive healthcare and lifestyle medicine research [21,24,25].

Future Research Agenda

Drawing on the synthesis of the fifteen analyzed articles and the knowledge gaps identified through bibliometric mapping, several priority research directions emerge. First, longitudinal intervention studies are urgently needed to evaluate the sustained behavioral effects of AI-based recommender systems across diverse populations and to better understand the long-term mechanisms influencing adherence to AI-supported lifestyle interventions [5]. Second, cross-national collaboration, particularly involving researchers from low- and middle-income countries (LMICs), should be strengthened to reduce the current geographic concentration of evidence in high-income settings. Third, comprehensive ethical and regulatory frameworks governing AI-derived lifestyle and genomic data remain underdeveloped, as data privacy, ethical governance, and regulatory issues continue to represent major barriers to the large-scale implementation of AI in healthcare [6].

Fourth, interoperability between wearable technologies and electronic medical record systems remains a significant technical challenge that must be addressed to enable seamless integration of AI-supported healthcare services [15,18]. Fifth, future bibliometric and conceptual studies should further clarify the conceptual boundaries of "AI in lifestyle medicine." Although umbrella-term search strategies improve literature coverage, they may also retrieve studies whose contributions are primarily methodological rather than directly related to lifestyle medicine. Therefore, future systematic reviews should incorporate explicit relevance-weighting criteria to distinguish core and peripheral evidence [8].

3.2. Discussion

Accelerating and Diversifying AI Research in Lifestyle Medicine Promotion

The bibliometric findings of this study confirm that global scholarly attention to AI applications relevant to lifestyle medicine promotion has followed a trajectory of sustained, incremental growth rather than the sharply bimodal pattern identified in the original, narrower search [18], established an early conceptual foundation demonstrating that multifunctional machine learning platforms can integrate dispersed patient data to support real-time clinical decision-making, while [15] provided concrete regulatory evidence of more than 60 FDA-approved AI-powered medical devices, indicating that AI maturity in clinical settings had already progressed beyond the experimental stage by 2020. The subsequent, more evenly distributed publication pattern across 2023–2026 suggests that the expanded search strategy has captured not merely a larger volume of literature, but a qualitatively different growth dynamic: rather than punctuated bursts of activity, AI scholarship touching lifestyle-relevant domains now appears to progress along a steadier, more continuous trajectory, consistent with the broader maturation of AI as a general-purpose technology diffusing across multiple institutional and disciplinary contexts [18].

Intellectual Structure and the Boundary of the Lifestyle Medicine Construct

The co-occurrence mapping generated by VOSviewer reveals an intellectual structure centered around artificial intelligence, with related thematic branches extending outward. A significant cluster connects machine learning, omics, and data-driven modeling to clinical precision medicine, highlighting AI's role in genomics-based oncology [10]. Notably, the isolated disaster management node in the network indicates that broad bibliometric searches, while justified by the idea that AI encompasses various sub-disciplines, may yield studies on the periphery of the target construct.

This raises the question of whether lifestyle medicine bibliometric mapping should prioritize inclusive umbrella-term strategies to maximize recall, or, more precisely, domain-focused strategies that might exclude relevant studies. The findings show legitimate trade-offs between the approaches and highlight the importance of transparent reporting of core versus peripheral cluster membership.

AI as an Instrument for the Personalization of Lifestyle Medicine

Consistent with the original ten-article synthesis, this expanded corpus reaffirms that AI has repositioned lifestyle medicine from a generic, population-level intervention toward a genuinely personalized paradigm. Early evidence demonstrated that AI, deep learning, and foodomics can support personalized dietary recommendations based on genomic, epigenetic, and microbiome information [14]. Subsequently, AI4FoodDB introduced an integrated database combining food imagery, wearable sensor data, validated questionnaires, and biological samples, thereby establishing a scalable methodological foundation for personalized lifestyle medicine interventions [15].

Complementing this evidence [18], AI-based recommender systems effectively promote healthy habits and active aging, although the persistent absence of systematic adherence mechanisms remains a critical constraint for the intelligent wearable systems for motion-intent prediction, though not originally framed within a lifestyle medicine context, offers a technically sophisticated foundation for the kind of continuous, biomechanically informed activity monitoring that future personalized lifestyle interventions will likely require [15].

Digital Health, the Metaverse, and Emerging Cross-Domain Frontiers

The convergence of the metaverse with artificial intelligence, Augmented Reality (AR), and Virtual Reality (VR) has considerable potential to transform the delivery of lifestyle medicine by improving public access to health information and increasing user engagement [23]. Augmented Reality (AR) and Virtual Reality (VR) technologies hold substantial potential to transform how lifestyle medicine is communicated and promoted to the public, enhancing both the accessibility of health information and the engagement of diverse user populations. Prior study reinforced this argument by showing that the convergence of IoT, 5G/6G connectivity, and AI computation has produced an increasingly integrated digital health ecosystem within which real-time lifestyle monitoring is becoming progressively more affordable and scalable [18]. The inclusion of [15] field-hospital data-management system and [16] Disaster-management expert-systems review further extends this digital health frontier into crisis and emergency contexts domains not traditionally associated with lifestyle medicine promotion, yet conceptually aligned through their shared grounding in predictive, preventive, and personalized care principles.

Similarly, the application of data mining and knowledge-graph techniques to higher-education quality assessment, while situated outside the health domain, exemplifies a methodological architecture for multi-source data integration, culminating in a random-forest evaluative model that is structurally analogous to the multi-source personalization pipelines employed in AI-driven lifestyle medicine platforms such as AI4FoodDB [23]. This structural analogy suggests that the value of including such peripheral studies lies less in their direct thematic content and more in the methodological templates they offer for future lifestyle medicine informatics research, a point corroborated by [6] explicit framing of their AI-marketing bibliometric analysis as a transferable methodological reference for adjacent research domains.

Future Research Agenda: Reconciling Breadth and Coherence

This cross-study synthesis highlights key research gaps in the field. First, there is a need for empirical validation, as much of the existing literature remains conceptual and lacks longitudinal designs to assess the long-term effectiveness of AI prompts on lifestyle changes. Second, the research is heavily skewed towards high-income populations, with AI nutritional models often failing to consider the realities of Low- and Middle-Income Countries (LMICs). Future studies should focus on community-level longitudinal trials in diverse settings to address this health equity gap. Third, ethical considerations surrounding personalized lifestyle data have not been adequately explored, and comprehensive ethical frameworks for AI-derived data remain underdeveloped despite recognized privacy concerns [6]. Fourth, challenges in integrating wearable technology with electronic medical records remain unresolved [25]. Lastly, future bibliometric reviews should adopt clear relevance-weighting criteria to differentiate significant contributions from less relevant studies, ensuring that the breadth of research does not compromise interpretive clarity in "AI in lifestyle medicine." In sum, future research should prioritize community-based studies, context-specific ethical frameworks, and clear methodological guidelines to promote inclusivity and coherence in this evolving field.

4. Conclusion

This bibliometric and qualitative synthesis of 15 articles published between 2020 and 2026 shows steady growth in research on the use of artificial intelligence (AI) to promote lifestyle medicine. The field is primarily grounded in machine learning, data-driven modeling, and personalized recommender systems, while peripheral clusters such as disaster-management expert systems, educational data mining, and physics-informed modeling reflect its expanding interdisciplinary scope and the interpretive risks of broad bibliometric searches. Overall, AI is shifting lifestyle medicine from generic population-level interventions toward individualized, data-driven care through wearable technologies, e-health nutrition databases, and digital behavioral recommender platforms.

Advancing this field requires coordinated action across three sectors. Public health policymakers should establish robust data governance and privacy frameworks to protect personalized behavioral and genomic data. Digital software developers should prioritize cross-platform interoperability to integrate wearable sensor data with local health registries. Health promotion researchers should move beyond descriptive science mapping toward multicenter longitudinal trials that assess the clinical effectiveness of algorithm-based behavioral nudging across diverse socioeconomic populations. Future research should prioritize community-based longitudinal studies of sustained behavioral outcomes, strengthen cross-national collaboration involving low- and middle-income countries (LMICs), and develop context-specific AI ethics frameworks to maintain conceptual coherence as the field continues to diversify.

Acknowledgment

The author appreciates the individuals and institutions that supported this study, as well as the bibliometric analysis tools and scientific databases used for data collection and analysis.

Conflict of Interest

There is no conflict of interest in this research.

REFERENCES

1. Topol EJ. High-performance medicine: the convergence of human and artificial intelligence. Nat Med [Internet]. 2019;25:44–56. https://doi.org/10.1038/s41591-018-0300-7
2. Dinh-Le C, Chuang R, Chokshi S, Mann D. Wearable health technology and electronic health record integration: Scoping review and future directions. JMIR mHealth uHealth. 2019;7. https://doi.org/10.2196/12861
3. Bajwa J, Munir U, Nori A, Williams B. Artificial intelligence in healthcare: transforming the practice of medicine. Futur Healthc J. 2021;8:e188–94. https://doi.org/10.7861/fhj.2021-0095
4. Krishnan G, Singh S, Pathania M, Gosavi S, Abhishek S, Parchani A. Artificial intelligence in clinical medicine: catalyzing a sustainable global healthcare paradigm. Front Artif Intell. 2023;6:1227091. https://doi.org/10.3389/frai.2023.1227091
5. Lopez-barreiro J, Garcia-soidan JL, Alvarez-sabucedo L, Santos-gago JM. Artificial Intelligence-Powered Recommender Systems for Promoting Healthy Habits and Active Aging : A Systematic Review. Appl Sci. 2024;14:1–18. https://doi.org/10.3390/app142210220
6. Al-Dekah AM, Sweileh W. Role of artificial intelligence in early identification and risk evaluation of non-communicable diseases: a bibliometric analysis of global research trends. BMJ Open . 2025;15:1–12. https://doi.org/10.1136/bmjopen-2025-101169
7. Wang T, He J, Yan W, Chen K, Zhang X, Zhang N, et al. Artificial intelligence in primary health care: A bibliometric analysis of publications from 2015 to 2024. Digit Heal. 2026;12:1–22. https://doi.org/10.1177/20552076251411631
8. Donthu N, Kumar S, Mukherjee D, Pandey N, Lim WM. How to conduct a bibliometric analysis: An overview and guidelines. J Bus Res. 2021;133:285–96. https://doi.org/10.1016/j.jbusres.2021.04.070
9. Gou F, Liu J, Xiao C, Wu J. Research on artificial-intelligence-assisted medicine: A survey on medical artificial intelligence. Diagnostics (Basel). 2024;14:1–52. https://doi.org/10.3390/diagnostics14141472
10. Hamamoto R, Suvarna K, Yamada M, Kobayashi K, Shinkai N, Miyake M, et al. Application of Artificial Intelligence Technology in Oncology: Towards the Establishment of Precision Medicine. Cancers (Basel). 2020;12:1–33. https://doi.org/10.3390/cancers12123532
11. Hanna MG, Pantanowitz L, Dash R, Harrison JH, Deebajah M, Pantanowitz J, et al. Future of Arti fi cial Intelligence d Machine Learning Trends in Pathology and Medicine. Mod Pathol. 2025;38:100705. https://doi.org/10.1016/j.modpat.2025.100705
12. Meskó B, Görög M. A short guide for medical professionals in the era of artificial intelligence. npj Digit Med [Internet]. 2020;3. https://doi.org/10.1038/s41746-020-00333-z
13. Yin J, Ngiam KY, Teo HH. Role of artificial intelligence applications in real-life clinical practice: Systematic review. J Med Internet Res. 2021;23. https://doi.org/10.2196/25759
14. Aria M, Cuccurullo C. bibliometrix: An R-tool for comprehensive science mapping analysis. J Informetr. 2017;11:959–75. https://doi.org/10.1016/j.joi.2017.08.007
15. Romero-Tapiador S, Lacruz-Pleguezuelos B, Tolosana R, Freixer G, Daza R, Fernández-Díaz CM. AI4FoodDB: a database for personalized e-Health nutrition and lifestyle through wearable devices and artificial intelligence. IEEE Access. 2023;11:74012–26. https://doi.org/10.1093/database/baad049

16. Thakur J, Kushwaha BP. Artificial intelligence in marketing research and future research directions : Science mapping and research clustering using bibliometric analysis. Glob Bus Organ Excell. 2024;43:139–155. https://doi.org/10.1002/joe.22233
17. Page MJ, Mckenzie JE, Bossuyt PM, Boutron I, Hoffmann C, Mulrow CD, et al. The PRISMA 2020 statement : an updated guideline for reporting systematic reviews. BMJ. 2021;372:1–9. https://doi.org/10.1186/s13643-021-01626-4
18. Ahmed Z, Mohamed K, Zeeshan S, Dong X. Artificial intelligence with multi-functional machine learning platform development for better healthcare and precision medicine. Database (Oxford). 2020;20:1–35. https://doi.org/10.1093/database/baaa010
19. Kwon DY. Personalized diet oriented by artificial intelligence and ethnic foods. J Ethn Foods. 2020;7:1–16. https://doi.org/10.1186/s42779-019-0040-4
20. Gaebel J, Schreiber E, Neumuth T. The Emergency Medical Team Operating System — a vision for field hospital data management in following the concepts of predictive , preventive , and personalized medicine International Classification of Diseases. EPMA J. 2024;405–13. https://doi.org/10.1007/s13167-024-00361-9
21. Li Y. Intelligent auxiliary evaluation method for higher education quality based on data mining technology. Discov Artif Intell. 2026;6:1–22. https://doi.org/10.1007/s44163-026-01225-z
22. Ahuja AS, Polascik BW, Doddapaneni D, Byrnes ES, Sridhar J. The Digital Metaverse: Applications in Artificial Intelligence, Medical Education, and Integrative Health. Integr Med Res. 2023;12:10–3. https://doi.org/10.1016/j.imr.2022.100917
23. Meng C, Griesemer S, Cao D, Seo S, Liu Y. When physics meets machine learning : a survey of physics-informed machine learning. Mach Learn Comput Sci Eng. 2025;1:1–23. https://doi.org/10.1007/s44379-025-00016-0
24. Ikegwu AC, Emereonye GI, Ebem DU, Uzuegbu VC. A review of artificial intelligence expert systems for environmental surveillance and disaster management. Discov Internet Things. 2026;6:1–22. https://doi.org/10.1007/s43926-026-00286-x
25. Chen S, Peng C, Yang B, Lin J, Zhou L, Jiang Z, et al. Recent advances in intelligent wearable systems: from multiscale biomechanical features towards human motion intent prediction. Npj Artif Intell. 2026;2:1–24. https://doi.org/10.1038/s44387-026-00083-5
26. Sweileh WM. Bibliometric analysis of peer - reviewed literature on food security in the context of climate change from 1980 to 2019. Agric Food Secur. 2020;1–15. https://doi.org/10.1186/s40066-020-00266-6