Literature Review

Cesar Martinez

Department of Informatics and Mathematics, Mercer University

INFM480: Capstone Project for IT & Informatics

Dr. Long

March 22, 2026

The increasing use of digital health technologies has created new opportunities for individuals to better understand and manage their personal health. Wearable devices, mobile health applications, and health tracking platforms now allow users to collect detailed physiological data such as heart rate, sleep patterns, physical activity levels, and caloric expenditure. As these technologies become more common, there is growing interest in using collected data to generate personalized health recommendations. This literature review examines the scientific background behind key health metrics used in personal health monitoring, the role of artificial intelligence and rule-based systems in generating recommendations, and the ethical and privacy considerations associated with digital health technologies.

Health Metrics Used in Personal Health Monitoring

Several physiological indicators are commonly used to evaluate overall health and wellness. Among the most widely used metrics is Body Mass Index (BMI), which estimates body fat based on an individual's height and weight. BMI has been used extensively in public health research to classify individuals as underweight, normal weight, overweight, or obese. Although BMI is useful for population-level analysis, researchers have also identified limitations in its accuracy, particularly for individuals with high muscle mass or unique body compositions. These limitations have led to discussions about complementary measures such as body composition, metabolic rate, and waist circumference in health evaluation.

Another important metric used in health assessment is Basal Metabolic Rate (BMR), which represents the number of calories the body requires to maintain basic physiological functions while at rest. BMR typically accounts for a large portion of an individual’s total daily energy expenditure and varies based on factors such as body composition, age, and sex.

Predictive equations such as the Harris–Benedict and Mifflin–St Jeor formulas are commonly used to estimate BMR when direct measurement through indirect calorimetry is not available. Research comparing predictive equations to calorimetry-based measurements suggests that certain formulas may provide relatively accurate estimates for many individuals, although accuracy can vary depending on the population being studied.

Physical activity and cardiovascular health indicators are also critical components of personal health monitoring. Heart rate metrics, including resting heart rate and heart rate variability, provide insight into cardiovascular fitness and recovery status. Studies have shown that heart rate–based training systems and wearable monitoring technologies can help individuals track exercise intensity and improve overall fitness outcomes. In addition, metrics such as VO_2 max, which represents the maximum amount of oxygen the body can utilize during exercise, are frequently used as indicators of aerobic fitness and cardiovascular health.

Sleep patterns represent another key component of overall wellness. Adequate sleep has been associated with improved cognitive performance, emotional well-being, and physical health. Wearable devices and sleep monitoring applications have made it possible to track sleep duration, sleep stages, and sleep consistency. Research suggests that sleep monitoring can help individuals identify patterns that may contribute to fatigue, poor performance, or health issues, thereby supporting healthier lifestyle decisions.

Nutrition and dietary intake also play an essential role in maintaining health. Government guidelines such as the Dietary Guidelines for Americans emphasize the importance of balanced dietary patterns that include appropriate proportions of macronutrients and micronutrients. Recommended Daily Allowance (RDA) guidelines help individuals understand the minimum

amounts of essential nutrients needed to prevent deficiencies and maintain physiological health. Research comparing dietary intake to recommended guidelines has shown that many individuals consume excessive amounts of carbohydrates and fats while failing to meet recommended levels for key micronutrients, highlighting the need for improved nutritional awareness.

Artificial Intelligence in Personalized Health Recommendations

As individuals collect increasing amounts of health-related data through digital devices, artificial intelligence (AI) and recommendation systems have emerged as powerful tools for analyzing this information and generating personalized health insights. AI systems are capable of processing large datasets and identifying patterns that may not be easily recognized through traditional analysis. In healthcare settings, AI-driven tools have been used to support clinical decision-making, predict disease risk, and provide personalized lifestyle recommendations.

One application of AI in digital health involves rule-based recommendation systems that generate suggestions based on predefined thresholds or guidelines. For example, a health application may analyze user metrics such as sleep duration, heart rate, and physical activity levels and then compare them with established health standards. If the system identifies that a user's sleep duration falls below recommended levels, it may generate suggestions aimed at improving sleep hygiene or adjusting daily routines.

More advanced predictive analytics systems incorporate machine learning algorithms that continuously refine recommendations as more data becomes available. These systems can analyze trends in user behavior over time and adjust recommendations accordingly. For instance, predictive models may detect patterns linking physical activity levels with improvements in heart

rate variability or sleep quality. As these patterns become clearer, the system can provide increasingly personalized guidance designed to support improved health outcomes.

Despite the potential benefits of AI-based health recommendations, it is important to recognize that automated systems cannot replace professional medical advice. Most digital health platforms emphasize that their recommendations are intended for informational purposes rather than clinical diagnosis. Maintaining this distinction helps ensure that users understand the limitations of automated health guidance.

Privacy and Ethical Considerations in Digital Health

The collection and analysis of personal health data raises significant ethical and privacy concerns. Health information is among the most sensitive categories of personal data, and improper handling of this information can have serious consequences for individuals. In the United States, regulations such as the Health Insurance Portability and Accountability Act (HIPAA) establish guidelines for protecting health information and ensuring that data is handled responsibly.

One major concern involves how digital health platforms collect, store, and share user data. Many wearable devices and health applications rely on cloud-based systems to process and store information, which may expose data to potential security vulnerabilities if adequate protections are not implemented. Developers must therefore implement strong encryption, secure authentication processes, and transparent data management practices to safeguard user information.

Another important ethical consideration relates to user consent and transparency. Individuals should clearly understand what data is being collected, how it will be used, and whether it may be shared with third parties. Transparent privacy policies and clear consent mechanisms are essential for maintaining trust between users and digital health providers.

Finally, there are concerns related to the potential risks of automated health advice. Although recommendation systems can provide helpful insights, inaccurate or overly generalized suggestions may lead users to make inappropriate health decisions. For this reason, many digital health systems emphasize that automated recommendations should complement, rather than replace, professional medical guidance.

Summary

Overall, existing research demonstrates that personal health monitoring technologies have the potential to significantly improve individuals' awareness of their health behaviors and physiological status. Metrics such as BMI, BMR, heart rate, physical activity levels, sleep patterns, and nutritional intake provide valuable insights into overall wellness. Advances in artificial intelligence and predictive analytics further enhance the ability of digital health platforms to generate personalized recommendations based on user data. However, the successful implementation of these technologies also requires careful attention to ethical considerations, including data privacy, user consent, and the limitations of automated health guidance. By integrating scientific health metrics with responsible data practices and AI-driven insights, personalized health monitoring systems may play an increasingly important role in supporting healthier lifestyles.