

# The Application of AI in Clinical Nutrition

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## Abstract

The concept of nutrition is moving towards therapy and helping in disease modification where the aim is to modify the contents of the diet in an attempt to attenuate the metabolic response to stress, to prevent oxidative cellular injury, prevent the scientific switching off of autophagy and to favorably modulate immune response. There are technical and ethical difficulties in performing experiments, formulating nutrition and delivering a comprehensive care are encountered. In most of the Indian ICU, enteral nutrition (EN) is very often prescribed by physicians with limited training in nutrition with use of approximations, estimations and sometimes even without scientific understanding. Generally, nutrition is not something that the average physician is even concerned about when it comes to illness and more-so in critical care. There is a dearth of trained dietitians in the country. The integration of technology can help in making critical care nutrition significantly scientific, simple and objective by helping to estimate the energy needs of the patient, probably determine the utilization of the proteins and calories and provide real time monitoring of the feed delivery by automated systems. Technology can further help in the data analysis with the help of electronic medical records for improving scientific knowhow. In the field of healthcare has witnessed a remarkable transformation in recent years, largely owing to the integration of Artificial Intelligence (AI) into various aspects of medical practice. AI, in its current state, has become a powerful tool for improving patient care, and one of its promising applications is in the realm of clinical nutrition. This article explores the growing significance of AI in clinical nutrition, highlighting its role in nutrition therapy across diverse healthcare settings.

**Keywords:** nutrition; patient; diabetes; diseases

## Introduction

### Understanding AI Today

Before delving into the application of AI in clinical nutrition, it is essential to define what AI represents today. Artificial Intelligence refers to the simulation of human intelligence in machines that are programmed to think and learn like humans. These machines are capable of performing tasks that typically require human intelligence, such as problem-solving, decision-making, language understanding, and pattern recognition.

In the context of healthcare, AI leverages advanced algorithms and data analysis techniques to assist healthcare professionals in diagnosing diseases, designing treatment plans, and improving overall patient care. One notable application of AI in healthcare is Clinical Decision Support Systems (CDSS), which play a pivotal role in guiding healthcare providers through complex medical scenarios.

### The Role of AI in Clinical Nutrition

Nutrition therapy has gained immense importance in modern healthcare, not only for disease prevention

but also for aiding recovery and improving overall patient outcomes. AI has found its way into various healthcare domains, and clinical nutrition is no exception. Here are some key areas where AI is making a significant impact:

### Outpatient Department (OPD)

In outpatient settings, AI-driven tools assist healthcare professionals in assessing patients' nutritional needs, planning personalized dietary interventions, and monitoring progress over time. These tools use patient data and medical guidelines to recommend tailored nutrition plans.

### Critical Care Nutrition

In critical care units, AI plays a crucial role in optimizing the nutrition delivery for patients who are critically ill. AI-driven systems can calculate the precise nutritional requirements of patients, monitor their intake, and ensure that they receive the appropriate nutrients for their condition.

### Women's Health and Maternity

AI-powered solutions are used to provide nutritional guidance to pregnant women, ensuring they receive the essential nutrients during pregnancy. These tools

can help manage nutrition-related complications and support healthy pregnancies.

### Diabetes Management

For individuals with diabetes, AI-based systems can assist in tracking blood glucose levels, analyzing dietary choices, and recommending suitable meal plans to help manage the condition effectively.

### Home Care and Palliative Care

AI is also becoming increasingly valuable in-home care and palliative care settings. It helps caregivers and patients manage nutritional needs at home, ensuring that individuals receive proper nutrition even when they are not in a clinical setting.

### Oncology and Autoimmune Diseases

In the context of cancer and autoimmune diseases, AI-driven nutrition management tools assist in designing specialized diets that support patients during their treatment journeys. These tools consider the unique nutritional requirements of patients with these conditions.

### Nutrition Management Tools

There are multiple technological advances that have helped the planning, and management of nutrition. Presently even while entering nutrition data in the usual electronic record there are facilities for voice prompts, alarms and red flags placed on the screen which would ensure early provision of enteral nutrition. While feeding in data during missed delivery or unstuffiness delivery would automatically calculate the deficit in protein, calories and micronutrients.

Such systems would help in setting up of aggressive and optimum feeding protocols with the help of computer-generated algorithms which help in increasing the enteral intake and thus provision of feeding

Personal digital assistant (PDA)based clinical decision support system (CDSS), Nutria, for the management of artificial nutrition has been developed and used in intensive care units for nutrition delivery after cardiothoracic surgery. It has demonstrated improvement in caloric intake in the intensive care unit. Nutria is an interactive, multi user, graphical frontend, computer-aided nutrition calculation program written in JAVA (Oracle Inc, California USA). Use of such a software has helped in stricter adherence to established guidelines

One noteworthy AI-driven solution in the field of clinical nutrition is Intimin which arguably appears to

be a game changer in this segment. This innovative tool, co-created by the author of this article is currently deployed in 15 of India's top-tier hospitals and serves approximately 3000 patients daily. Intimin is a web application designed to empower clinical nutrition teams, including dietitians, physicians, nurses, and food and beverage professionals. It streamlines the nutrition management process, addressing malnutrition cases in hospitals while minimizing food wastage. This software-based nutrition management tool performs an array of tasks. Automated Anthropometric Data Calculation: Intimin automates the calculation of ideal, actual, and adjusted body weight based on chosen BMI formulas. This eliminates the need for manual calculations and potential errors.

Nutritional Assessment and Screening Tools: The tool provides access to various assessment and screening tools, including Nitric Score, Nutritional Risk Screening (NRS), Subjective Global Assessment (SGS), and more. These tools aid in comprehensive patient evaluation.

Customized Nutritional Recommendations: Intimin suggests macro-nutritional requirements based on guidelines from the European Society for Clinical Nutrition and Metabolism (ESPEN) and the American Society for Parenteral and Enteral Nutrition (ASPEN). It can also integrate readings from indirect calorimeters for precise calorie requirements.

Nutrition Delivery Management: The tool facilitates the management of nutrition delivery, including kitchen feed, enteral or parenteral nutrition, and additives. It monitors delivery and deficits, enabling healthcare professionals to track patient recovery due to improved nutrition.

The next frontier for similar software's and the Intimin is AI integration, which involves leveraging Large Language Models (LLMs) and semantic search. Integration of such software's like the Nutrimint with search engines like AIDE/PubMed search etc., in the author's opinion, help to provide evidence-based insights to healthcare professionals with 100% accuracy, relying on references from evidence-based papers and documents.

The use of a software like this would help in data generation. Integration of this data on real time basis along with vital signs and investigations will give an opportunity for analysis. Artificial intelligence tools use neural networks and fuzzy logic which can quickly learn and allow for the ultimate optimal "smart"

system with the ability to learn and adapt to varying situations.

### **Challenges in AI Implementation in Clinical Nutrition**

Despite the potential benefits of AI in clinical nutrition, there are challenges that need to be addressed

#### **Generalized Datasets vs. Medical Datasets**

One major problem with AI implementation in clinical nutrition, as well as in healthcare in general, is the reliance on generalized datasets. These datasets may not always align with the specific medical data required for accurate nutritional assessments and recommendations.

#### **Resistance to AI Adoption**

Resistance to AI adoption in healthcare can be attributed to concerns about its reliance on non-specialized data sources. Healthcare professionals may be hesitant to trust AI recommendations if the underlying data sources are not from trusted and reliable medical references.

#### **The Need for Primary and Secondary Knowledge Sets**

To ensure the accuracy of AI-driven clinical nutrition solutions, primary knowledge sets from medical literature and secondary knowledge sets from specialized sources are essential. The integration of these knowledge sets helps in making more informed and reliable recommendations.

#### **Advancing Clinical Nutrition and Dietetics with AI: Tailored Solutions for Dietitians**

The world of clinical nutrition and dietetics is undergoing a profound transformation, thanks to the integration of Artificial Intelligence (AI) into the field. Dietitians, in particular, are experiencing a paradigm shift in the way they assess, plan, and manage their patients' nutritional needs. In this article, we explore the various facets of AI in clinical nutrition and dietetics, with a specific focus on how AI-powered tools are being tailored to meet the unique needs of dietitians.

#### **The Role of AI in Clinical Nutrition and Dietetics as an Ally**

Before delving into the specialized versions of AI tools designed for dietitians, it's crucial to understand the broader role of AI in this field. AI, in its current state, is a powerful ally for dietitians, enabling them to provide more accurate, efficient, and personalized

nutritional guidance to their patients. Here are some key areas where AI is making a significant impact:

#### **Nutritional Assessment and Personalized Planning**

AI-driven tools like intimin assist dietitians in assessing patients' nutritional needs more comprehensively. These tools take into account a wide range of factors, including medical history, dietary preferences, and specific health conditions. As a result, dietitians can create highly personalized nutrition plans that are tailored to each patient's unique requirements.

#### **Monitoring and Tracking Progress**

AI-powered platforms will enable physicians and dietitians to monitor and track their patients' progress more effectively. By analyzing data from wearables, patient-reported outcomes, and other sources, dietitians can make real-time adjustments to nutrition plans and offer timely guidance to their patients.

#### **Optimizing Clinical Decision Support**

Clinical Decision Support Systems (CDSS) powered by AI provide (Healthcare Professionals) HCPs with evidence-based recommendations and guidelines. These systems help dietitians make informed decisions about dietary interventions, ensuring that their advice is in line with the latest research and best practices.

#### **Enhancing Patient Engagement**

AI-driven apps and platforms encourage patient engagement by providing educational content, meal planning assistance, and reminders for tracking dietary intake. This engagement fosters better adherence to nutrition plans and improves overall patient outcomes.

#### **Avenues for leveraging AI in clinical nutrition CDSS Version - Streamlining Nutritional Guidance**

The CDSS (clinical decision support systems) Version of AI could be designed to be a clinical nutritionist's trusted companion in providing evidence-based nutritional guidance. It could rely on knowledge-based datasets sourced from a vast array of nutrition-related research, including PubMed ID articles and PMC article datasets. Furthermore, it could cover critical aspects of nutrition, such as drug-to-drug interactions, drug and food interactions, and map branded drug names to generic names in different regions.

Thus, AI could empower clinical nutritionists with a comprehensive database of nutritional knowledge, enabling them to make more informed decisions when creating dietary plans for their patients all the time keeping them abreast with latest research, guidelines, and insights, resulting in more effective nutritional interventions.

### **PG and UG Learning Version - Shaping the Future of Dietetic Education**

Education is the cornerstone of the dietetics profession, and AI has the capacity to play a pivotal role in revolutionizing the way clinical nutritionist could be trained.

To support the education of future clinical nutritionists, the AI would require access to proprietary datasets from medical book publishers and question banks. It would thus serve as a valuable educational tool that offer in-depth insights into nutritional concepts, clinical scenarios, and dietary planning supplements traditional coursework, ensuring that clinical nutritionist is well-prepared to meet the challenges of real-world nutrition practice.

### **Optimizing Dietetic Consultations**

AI could streamline the process of integrating patients' primary health data into dietary consultations helping to interpret various data formats, including PDFs and Discom files, to create concise and informative summaries. In practical terms, this means that clinical nutritionist can significantly save time during patient consultations. AI has the capacity to efficiently extract relevant information from patient records, medical reports, and diagnostic tests, providing a comprehensive overview of the patient's health and dietary needs.

### **Optimizing nutrition practice in the community**

Datasets from reputable open patient support communities, such as MedlinePlus and Mayo Clinic, could be integrated into the dietitian's toolkit which can guide patients to access credible information, engage with peer support groups, and contribute to reviews and discussions related to nutrition and health. AI assists in organizing and curating community-generated content, making it easily accessible and trustworthy. This would empower patients to become well-informed advocates for their health, leading to better adherence to dietary plans and improved health outcomes.

### **Optimizing nutrition research using AI**

AI may serve as a catalyst for innovation and scientific discovery in the field of dietetics. It would help in supporting researchers, institutions, and data scientists in conducting rigorous studies and collaborative research efforts related to nutrition and dietary science.

This has the power to facilitate retrospective studies, data analysis, and the exploration of new research questions in the realm of clinical nutrition and dietetics.

Researchers could also draw insights from real-world patient data, enabling advancements in dietary practices and therapies.

### **Conclusion**

Increasing availability of newer monitoring tools, re-defining of the nutritional standards based on individual needs, evaluation of organ functions with newer technology, more and more of available data on critical illness and a better co-ordination between various medical specialties will definitely help in optimizing the delivery of nutritional care. The specialized versions of AI tools tailored for dietitians are poised to revolutionize the field of clinical nutrition and dietetics. These AI-powered solutions empower Healthcare professionals including physicians and dietitians to provide evidence-based, personalized dietary guidance to their patients, enhance their education and training, optimize their practice, foster patient engagement, and contribute to cutting-edge research in the field of nutrition. As AI continues to evolve, it will play an increasingly vital role in elevating the standards of care in clinical nutrition and dietetics, ultimately leading to improved health and well-being for individuals and communities. intimin, in the authors opinion with its AI integration plans, promises to enhance the accuracy and efficiency of nutritional care delivery. As AI continues to evolve and adapt to the specific needs of healthcare, it has the potential to revolutionize clinical nutrition, ultimately leading to improved patient outcomes and a healthier future for all.

### **References**

1. Obermeyer, Z., & Emanuel, E. J. (2016). Predicting the future—big data, machine learning, and clinical medicine. *New England Journal of Medicine*, 375(13):1216-1219.

2. Esteva, A., Robicquet, A., Ramsundar, B., et al. (2019). A guide to deep learning in healthcare. *Nature Medicine*, 25(1):24-29.
3. Boushey, C. J., & Kerr, D. A. (2017). Wright, J.L., Lutes, K.D., Linnan, L., Preparing Registered Dietitian Nutritionists for leadership in digital health. *Journal of the Academy of Nutrition and Dietetics*, 117(10):1495-1498.
4. Zhang, H., & Gao, Y. (2019). Artificial intelligence in clinical laboratory diagnostics. *Clinica Chimica Acta*, 498:6-12.
5. Kawamoto, K., Houlihan, C. A., Balas, E. A., & Lobach, D. F. (2005). Improving clinical practice using clinical decision support systems: a systematic review of trials to identify features critical to success. *BMJ*, 330(7494):765.
6. Sasheedharan, S. et al. suggestion based software called as “intimin” helps to screen out the patients which are at risk of malnutrition, formulate a plan, monitor and manage enteral nutrition of patients.
7. Dugdale, D. C., & Wu, J. S. (2020). Artificial intelligence and machine learning in diabetes care. *Journal of Diabetes Science and Technology*, 14(1):15-19.

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