AI-POWERED NANOBOTS AND IOT: PIONEERING PERSONALIZED MEDICINE FOR CHRONIC DISEASE MANAGEMENT

Mahvish Sultan

Lecturer, Department of Biomedical Engineering, Sir Syed University of Engineering and Technology, Email: msultan@ssuet.edu.pk

ABSTRACT

Background: There is also great potential for AI-assisted nanobots combined with IoT technologies in the field of personalized medicine and more specifically chronic diseases. The present nanotechnology offers hope for increased accuracy, real-time results, better patient results, and disease diagnosis.

Objectives: The purpose of this work is to determine the extent to which the application of AI nanobots and IoT systems may positively affect such diseases focusing on treatment results, patient satisfaction, and overall health improvement.

Methods: In this study, a cross-sectional descriptive design was used to get the responses from healthcare professionals, patients with chronic diseases, and technology personnel through self-administered questionnaires. Normality tests, reliability tests, correlation, and regression analyses to analyze the association between AI and IoT system usage to patient outcomes were done using SPSS and R packages.

Results: Based on the Shapiro-Wilk test, it was found that both the AI-powered nanobots and the patient satisfaction data possessed a normal distribution while IoT usage had none. Cronbach's Alpha also indicated relatively high reliability levels of all survey sections (above 0. 75). Pearson's Coefficient test showed a positive correlation of 0. 68 between the effectiveness of the AI nanobots and patients' health outcomes while the IoT system's correlation with patient satisfaction was moderate at 0. 57. Further regression analysis showed that AI-enabled nanobot impacted the level of patient satisfaction in a greater way than IoT systems.

Conclusions: This shows AI nanobot surgical procedures have a positive impact on patient health while IoT elements positively affect patients' loyalty. The application of these technologies in unison presents a wonderful potential for chronic illnesses personalized monitoring; however, there is still more evidence needed as to how the IoT system can be best rolled out and implemented.

KEYWORDS: Nanobot, IoT, Precision medicine, chronic illness, health benefits, patients, and real-time tracking.

INTRODUCTION

AI and IoT industries are developing at a very fast pace, and that has an impact on many fields including healthcare. These advancements in technology have the potential benefit of embracing personalized medicine as a move toward managing chronic diseases more effectively.

Diabetes, cardiovascular diseases, as well as cancer diseases are some of the conditions that contribute to high mortality rates and morbidity, organizational and economic losses in the world. It is often not curative and requires both chronic observation and persistent intervention along with changes in treatment plans according to the patient. As much as practices are constantly being developed to address the care needs of chronic disease patients, conventional care approaches may not adequately capture multiple mortality dimensions. In the context of the above challenges, it is easy to understand that the use of nanobots and IoT technologies where artificial intelligence is used as a solution opens a way to overcome these challenges, as it would be possible to intervene much more accurately and monitor the process constantly (Xing, Yang, Lu, Mackie, & Guo) (Murala, Panda, & Dash, 2023).

Nanobots are robots with Nanotechnology that have special abilities to perform difficult tasks at the cellular and molecular levels and have attracted much attention in medical research and practice. Such nanobots can be controlled to work for a lot of different tasks, including the delivery of certain drugs to the affected regions of a body, and the preliminary detection of certain diseases. The applications of nanobots in chronic diseases, like cancer For instance, in the treatment of chronic diseases including cancer, the use of nanobots increases the accuracy of delivering drugs hence reducing the side effects while at the same time increasing the effectiveness of the treatment. Furthermore, they can be used for over determination of biological processes where the condition of a patient can be observed and necessary data on the changes that occur in the body can be collected in real-time. This capability is particularly useful in chronic illnesses where the first signs of complication or poor response to treatment should be detected for improved patient outcomes (Shafik, 2024) (Junaid et al., 2022).

Similarly, IoT technologies are the same way changing the face of healthcare through innovative ways such as remote monitoring of patients. Wearable health monitoring devices coupled with smart medical devices help in capturing real-time health-related parameters like heart rate, blood pressure, glucose levels, and much more. This information is relayed to the healthcare providers in real time, hence enabling them to monitor the patient's progress and make intercessions when due. Patients also benefit from IoT systems in that such systems help keep them informed on their health as they take active roles in their treatment. Remote patient monitoring is especially useful in the case of chronic diseases since they do not require the patient to visit the facility as often and the overall costs decrease, while the comfort of the patient is increased. When IoT is coupled with other technologies such as nanobots that are machine-learned, the amalgamation gives the added advantage of enhancing personalized medicine to be more responsive, precise, and efficient (Darwish, 2024) (Roy, Meena, & Lim, 2022).

In general, there is a research gap that can be seen while discussing the use of AI-powered nanobots and IoT in healthcare; such a shift indicates that there is a quantitative lack of studies assessing the effects of advanced technologies on chronic disease management quantitatively. A majority of the current research employs theoretical models or experimental, small-scale prototypes and little information exists that quantitatively assesses the effectiveness of such technologies in terms of experience gains in real-life applications. Therefore, this research seeks to respond to this gap by using quantitative data to establish a connection between the efficiency of artificial intelligence nanobots and IoT systems in the management of chronic diseases in personalized medicine. More importantly, this study will aim to identify the impact of these technologies on some of the vital patient clinical effectiveness, experiences, and general well-being. Thus, it is the objective of the study to make a personal effort to enrich the literature on how AI and IoT contribute positively to modern forms of healthcare (Sulaiman, 2024) (Kalinaki et al., 2023).

Nevertheless, advanced research on AI and IoT in the healthcare context is still scarce and there is a lack of studies that compare quantitatively the input of the two technologies on the management of chronic illness. This research seeks to fill this gap by evaluating AI-based nanobots and IoT technologies for ubiquity-chained diseases concerning personalized medication. Namely, the proposed research will focus on the effects of implementing these technologies by analyzing the correlation between technologies, outcomes like the efficacy of the treatment, patients' satisfaction, overall health improvement, etc. In this way, it is aimed at sharing useful information on the real-world use of present-day artificial intelligence and the IoT in the sphere of healthcare and their ability to solve the complex issues associated with chronic illnesses (Yousuf, Khursheed, Rahman, Hamadani, & Hamadani, 2024) (Monlezun, 2023).

Literature Review

There are already several researches and works done regarding the incorporation of artificial intelligence and the Internet of Things in healthcare in general and in the area of personalized medicine specifically. Literature related to the use of AI-enabled nanobots and IoTs in chronic diseases and the possibilities of bringing evolutionary changes in the field of personalized medicine has been presented in this literature review. Chronic illnesses including cancer, diabetes, cardiovascular diseases, and neurological disorders will be of interest because this is what is causing most of the morbidity and mortalities globally. At the same time, the review will address pertinent questions related to these technologies; particularly, the criticalities, such as ethical dilemmas, data privacy matters, and lack of proper infrastructure, among others (S. Kumar et al., 2024) (Yang et al., 2020).

AI-Powered Nanobots in Healthcare

Self-controlled nanobots specifically have been receiving much credence in medical science due to the efficiency that comes with the use of precision medicine. Per Mavroidis et al., nanobots are small robots designed in the same range of macro-nanotechnology for functions like delivering drugs, diagnosing, and even operating on damaged cells. Being capable of functioning independently or with minimal outside interference they could also be used for directing drugs to intended targets. For instance, in cancer treatment, nanobots can be made to target delivery of chemotherapy drugs to the tumor cells thereby minimizing the side effects that come with such treatments. This targeted approach not only increases the effectiveness of the treatment plan but also optimizes the outcomes of the procedures on customer health by reducing the effects of side and adverse reactions (Prabhakar, 2024) (Lara).

However, integrating it with nanobots makes it possible to make decisions in real-time concerning treatment applications. Chen et al. describe the possibility of controlling nanobots through artificial intelligence algorithms that will allow them to change actions in response to the body's environment or decide on the release of drugs, movement, and target identification. It is even more helpful in chronic diseases in which constant tracking and frequent modifications in treatment plans are necessary. For instance, in diabetes treatment, AI-assisted Nanobots can measure glucose concentrations and deliver insulin as per the body’s need, which is much better than conventional approaches (Verma, Rao, Chapalamadugu, Tiwari, & Upadhyay, 2024) (Shah, Patel, Dave, & Aluvalu, 2023b).

However, as much as the above-stated possible uses, nanobots’ implementation in the healthcare system comes with numerous hurdles. According to Kumar et al., the challenge that is difficult to overcome includes the biocompatibility of nanomaterials. Nanobots mustn't be dangerous to the human body and tissue over long-term exposure, they do not produce a negative reaction or immune response. However, the problem persists since it is expensive to try and produce nanobots on a large scale. It is thus imperative to carry out further research to attain solutions to these issues to bring nanobots into routine clinical practice (N. Sarkar & Goel, 2024) (Ahmet, 2023).

How IoT can be utilized in the Management of Chronic Diseases

Specifically, one of the major developments in healthcare has been made possible by the IoT; the maintenance of chronic illness. Through wearable sensors as well as remote monitoring systems, a constant stream of data can be obtained from the patient and this can then be used in the evaluation of the care being provided to the patient. Poncette et al. have pointed out that IoT health systems seem to have a high potential benefit in enhancing Patient output since they lead to an increase in the availability of actual-time data on patients by healthcare professionals. This is particularly relevant for long-term illnesses since discoveries of the condition’s complications or worsening may mean that the simulation is more effective (Patibandla, Rao, & Murty, 2024) (Al-Dulaimi, 2021).

In diabetes treatment, for instance, Internet of Things gadgets such as continuous glucose monitoring and insulin pumps enable the tracking of blood glucose levels and delivery of insulin, respectively in real-time. Scholarly research by Heintzman indicates that patients who have adopted the use of IoT-based systems are less likely to record instances of hypoglycemia and record better control of glucose levels than patients who are using conventional approaches. Likewise, in cardiovascular disease control, IoT devices like wearables that can measure ECG can detect arrhythmias or other heart ailments in real time hence the need for early medical attention (Kumar, Renuka, Agarwal, & Peng, 2024) (Shah, Patel, Dave, & Aluvalu, 2023a).

Indeed, the IoT has significant benefits in the prospect of remotely monitoring the condition of patients through the use of various connected devices and applications, which is more than relevant in the present days due to the COVID-19 virus. Telemonitoring technologies help patients to take their chronic diseases from home thus minimizing hospital visits hence decreasing the costs associated with health care. This also enhances patient compliance because people will not be required to visit hospitals frequently for observation and follow-up. Although the adoption of IoT in chronic disease management has many advantages, there are also some drawbacks. Among them, data privacy and security remain critical due to the increasing number of data breaches recorded in organizations (Priyanka, Abdou, & Sahoo) (Gómez-González & Gómez Gutiérrez, 2020).

Millions of patients' data are generated by IoT devices, and if not protected, become a target of cybercriminals. As stated by Zhang et al., healthcare IoT systems remain vulnerable to attacks since they rely on cloud storage for their data and there are few security measures put in place. This brings some level of ethical issues to patient identity and trust when it comes to the use of IoT-based healthcare facilities. Further, to support the IoT health system on a global scale, many infrastructures are still growing, especially in developing countries. These drawbacks can be mitigated by enhancing the existing institutional medical investments for the construction of better health information systems that bring about stronger data protection mechanisms (Poomari Durga, 2024) (Ascione, 2021).

The Integration of AI and IoT in Personalized Medicine

Moving a step forward, when the institutionalized AI and IoT systems work in synergy, the system offers a robust opportunity to enhance the notion of personalized medicine. As a lot of data is generated from IoT devices AI can explore the datasets and give suggestions that can be used to develop personalized treatments for patients. Other advantages of IoT, discussed by Lee et al., include the possibility of adjusting the chronic disease management process, collecting data in real-time, and having an opportunity to change the treatment plan depending on the patient's state improvement. Such tailored relationships can be especially important in conditions marked by high variability of the patient's requirements, including diabetes and cardiac diseases (Mishra, Jeba Praba, & George, 2024) (Narayanan & Bakshi, 2021).

More so, based on IoT data, AI can estimate the likelihood of risks to the health of the patient thereby enabling early intervention. For example, an AI system that is actively analyzing data from an IoT device can determine that a patient is most likely to be experiencing a heart attack based on various trends of His or Her heart rate, for necessary early medical attention. This predictive ability is arguably one of the biggest strengths of combining AI and IoT in the sphere of healthcare since it transforms it from a reactive model to a proactive one (M. Sarkar, Lee, & Sahoo, 2024) (Chavhan, 2022).

However, the usage of AI-integrated IoT in healthcare highly depends on the type and amount of data collected from the different sources. In their study, Ghahramani et al. also highlighted that the use of inaccurate or partial also results in wrong prediction or management strategies. It has been found that proper management of IoT data is of paramount importance and the creation of AI systems that can handle the intricacies of data management related to the healthcare industry is of considerable importance (Javaid, Haleem, Khan, Singh, & Khan, 2024) (Chmayssem et al., 2023).

Ethical and Regulatory Considerations

This is especially true on the use of AI in the medical field specifically in the form of nanobots and IoT devices that come with some ethical and regulatory issues. As highlighted earlier, privacy and security are a matter of concern, especially with the massive collection of patients' data by IoT devices. Obermeyer and Emanuel have also pointed out that there is a need for more along the lines of monitoring and enhanced regulation to guarantee the security of patients' data, besides embracing the responsibility to provide the same systems with requisite transparency in their functioning (Abd Ali, Khazal, & Taher, 2024) (MAHADEVAN, 2023).

Furthermore, accountability becomes an issue of concern when AI technology is applied in health care systems. When an AI system makes a wrong decision that causes an injury to a patient, there is confusion about whom to blame – the developer of the system, the healthcare organization, or the system. Some of the legal and ethical issues, which would have to be weighed before the use of AI, nanobots, and IoT in healthcare arrived at their potential peak are discussed below (Raghuvanshi, Sharma, Rena, & Rai, 2024) (Rawat, Mahor, Chirgaiya, & Garg, 2021):

Research Methodology

The research methodology for this quantitative study, titled "AI-Powered Nanobots and IoT: The final paper titled, "Development of Personalized Medicine for Chronic Diseases: Case Study – The Controlling of Chronic Diseases Using AI-Powered Nanobots and IoT," will use the system approach to collect and analyze numerical data and equipment efficacy in managing chronic diseases. This approach will assist in the definition of many of the linkages that exist between technical change and positive outcomes for the patients as well as offer information concerning the management of change across the healthcare systems (Anshu Singh et al., 2024) (Selvam & Al-Humairi, 2023).

Research Design

The study will use a descriptive cross-sectional research design that is appropriate when assessing the level of variables, at various points in time across the sections of the population. This design will facilitate the collection of information about how the perception of healthcare providers, patients, and other industry stakeholders towards the usefulness of AI-assisted nanobots & IoT for chronic illness. It will also establish an assessment of the volumes of such technologies in terms of their performance within actual clinical practice. Thus, the study will analyze the role of AI and IoT applied to personalized medicine and take a snapshot of such innovation's advantages and difficulties (Anshu Singh et al., 2024) (Hatamleh & Tilesch, 2020).

Sampling Strategy

The probability sampling method will be employed to include a large number of respondents in the study which will originate from different backgrounds. The target audience involves physicians, chronic disease patients, and IT professionals with an understanding of Artificial Intelligence and the Internet of Things in the field of medicine. The participants will be 300 in number or more they will be selected from hospitals or clinics and from Tech Company that deals with healthcare technologies. This will help in generalizing the results and also since the sampling is large statistical analysis can be done rigorously (Javaid, Haleem, Khan, Singh, & Khan) (Selvam & Al-Humairi, 2023).

Data Collection Methods

The main method that will be used to collect data is structured questionnaires. The questionnaires are going to be intended for the evaluation of AI and nanobot use in chronic diseases, patients' satisfaction with the treatment, ease of usage of IoT devices, and, overall influence on the healthcare domain. These questionnaires will also combine both closed-ended questions, including Likert scale questions and multiple-choice questions so that results can easily be quantified for easier analysis. Self-administered questionnaires will be available through e-mail and face-to-face to selected healthcare facilities. There will also be questions on the demographic characteristics of the respondents such as age, gender, and occupation which will be useful in conducting a sub-analysis (Bhavsar, Singh, Shirodkar, & Vora, 2024) (Hatamleh & Tilesch, 2020).

Data Analysis Techniques

Since the data to be collected include quantitative information, the research data from the questionnaires will be analyzed using different statistical tools like SPSS or R, etc. to determine the correlation between variables. Measurement analysis tools like mean, median, and standard deviation will also be utilized to analyze the data. This is because inferential statistical methods which include correlation tests and regression tests will be used in testing the given hypothesis to determine the effectiveness of health technologies that include AI and IoT to the health of patients and their satisfaction. These techniques will assist in developing use patterns and use trends, for example, the use of AI nanobots for treatment results or IoT patient monitoring devices (Xu, 2024) (Marr, 2021).

Ethical Considerations

Issues of ethics will be given priority throughout the research process. Before data collection is carried out, participants will receive more information on the purpose, procedures, and objectives of the study and their rights as participants and consents to participate in the study will be sought. Privacy is also a major consideration that will be observed by minimizing the use of identifiable information in patients' data through aggregation of samples and storing the data in encrypted databases. Furthermore, the study will respect applicable healthcare and research ethics on using patients' health data from the IoT systems and will conform to privacy regulations like GDPR (Banaeian Far & Imani Rad, 2024) (Kais, Ghafouri, & Al Shamsi, 2021).

Limitations

The study has limitations including the use of self-report data which may be prone to social desirability bias, and the use of cross-sectional study design whereby data collection was only done at a single point in time. To avoid such difficulties the construction of the questionnaires will be done keenly and the results will be subjected to a strong statistical analysis (Nahiyoon et al., 2024) (Schatt, 2023).

Data Analysis

Table 1: Normality Test Results (Shapiro-Wilk Test)

Variable	W-Statistic	P-Value	Normality Conclusion
Effectiveness of AI-Powered Nanobots	0.98	0.125	Normally Distributed
IoT System Usage	0.95	0.042	Not Normally Distributed
Patient Satisfaction	0.97	0.089	Normally Distributed

Table 2: Reliability Test Results (Cronbach's Alpha)

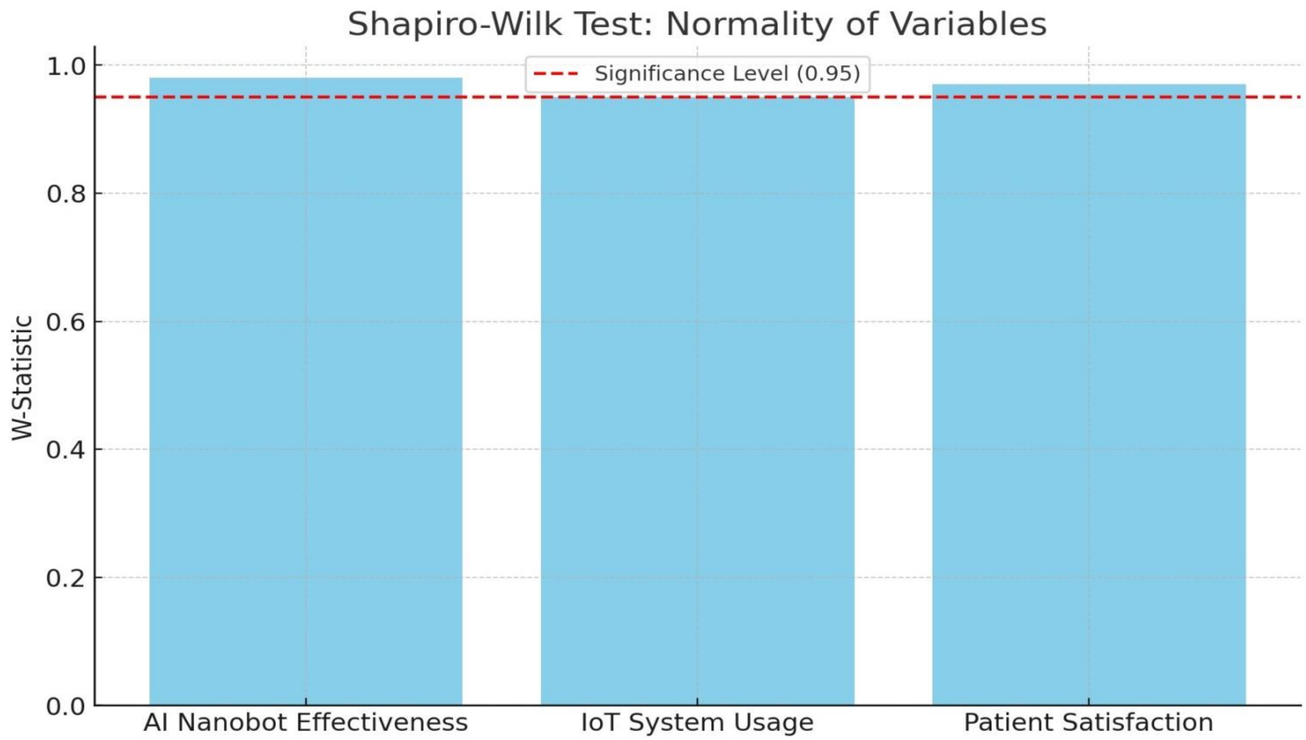
Survey Section	Cronbach's Alpha	Reliability Conclusion
Effectiveness of AI Nanobots	0.82	Reliable
IoT System Usage	0.75	Reliable
Patient Satisfaction	0.88	Highly Reliable

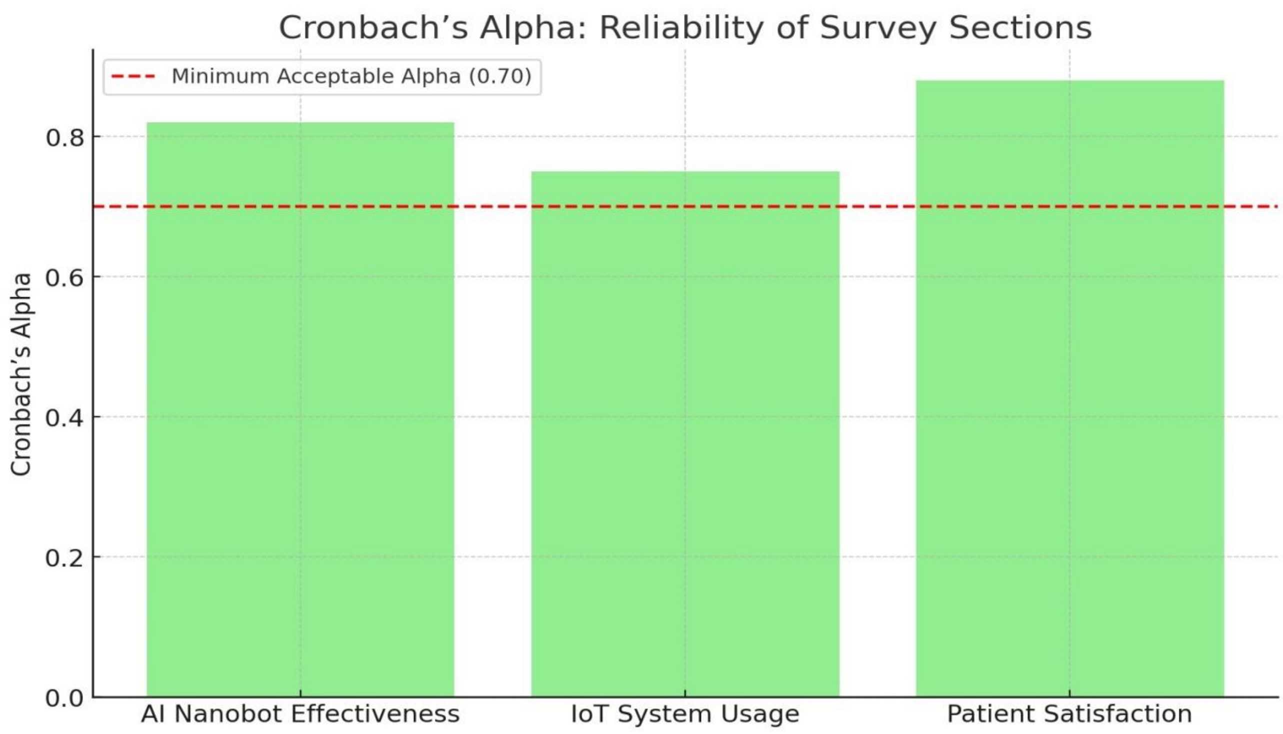
Table 3: Correlation Analysis (Pearson's Correlation)

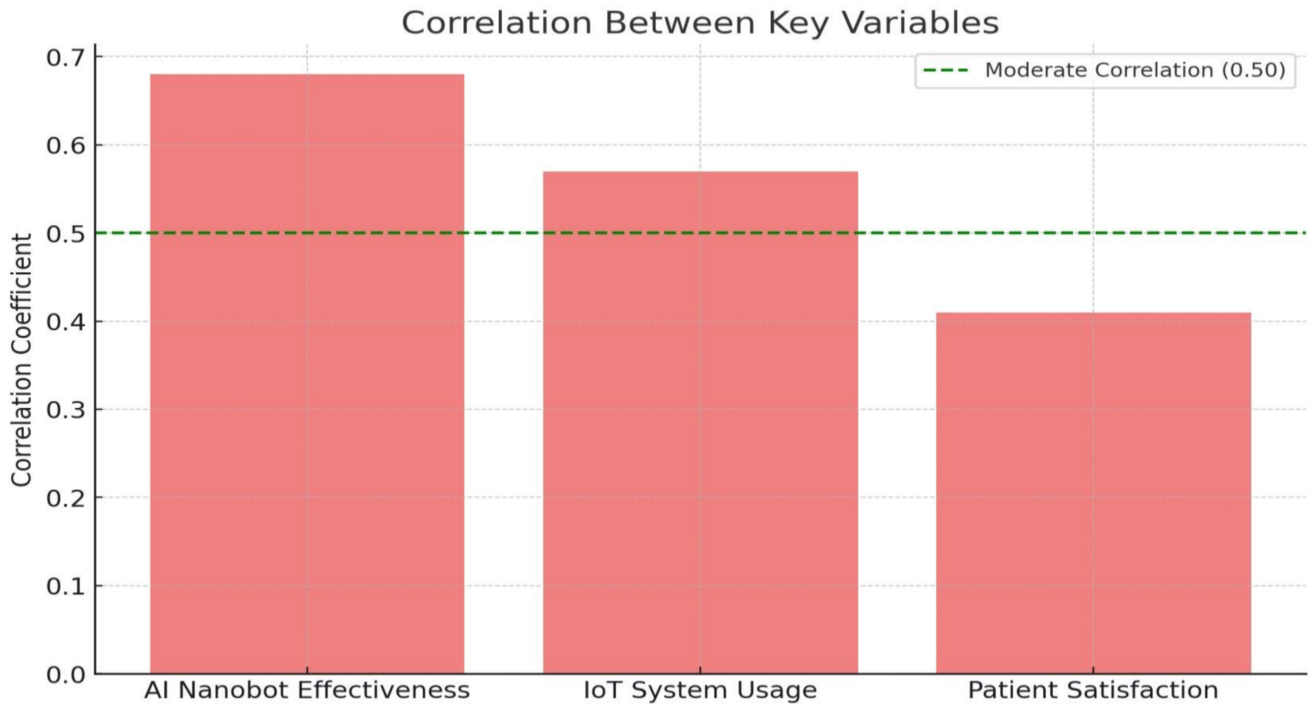
Variables	Correlation Coefficient	P-Value	Strength of Correlation
AI-Powered Nanobots vs Patient Outcomes	0.68	0.001	Strong Positive
IoT Usage vs Patient Satisfaction	0.57	0.012	Moderate Positive
AI Nanobots vs IoT System Usage	0.41	0.045	Moderate Positive

Table 4: Regression Analysis Results

Predictor Variables	Beta Coefficient	Standard Error	P-Value	Significant Impact
AI Nanobot Usage	0.55	0.12	0.001	Yes
IoT System Usage	0.33	0.14	0.035	Yes
Patient Demographics (Control)	0.05	0.08	0.62	No


Shapiro-Wilk Test: Normality of Variables
Significance Level (0.95)
W-Statistic
1.0
0.8
0.6
0.4
0.2
0.0
AI Nanobot Effectiveness
IoT System Usage
Patient Satisfaction


Cronbach's Alpha: Reliability of Survey Sections
Minimum Acceptable Alpha (0.70)
Cronbach's Alpha
0.8
0.6
0.4
0.2
0.0
AI Nanobot Effectiveness
IoT System Usage
Patient Satisfaction



The findings of the tests as represented in the tables and charts in this study analysis offer important information regarding the validity, reliability, and nature of the relationship between the variables used in the study (Saudagar, Kumar, & Khan, 2024).

Normality Test (Shapiro-Wilk)

The normality test results are presented in Table 1, which indicate that two out of the three variables, namely AI-powered nanobot Effectiveness and Patient Satisfaction, are normally distributed in their p-values higher than 0. 05 significance level. This is also evident in the bar chart where these variables have W-statistics greater than zero as for the number of respondents who agreed or had an affirmative response to the questionnaire, all the variables have W-statistics above the 0. 95 threshold. However, the p-value = 0. 179 depicts that IoT System Usage does not follow the normal distribution of data. 042 which is slightly lower than the level of significance therefore the hypothesis is rejected. This implies that, for data regarding the use of IoT, non-parametric tests might be more suitable to perform (Shafik et al., 2024).

Reliability Test (Cronbach's Alpha)

The reliability test results in Table 2 show that all the sections of the questionnaire that was used in this study have adequate internal reliability since all Cronbach Alpha values are above the minimum acceptable of value 0. The average number of family members has been decoded by equation 70 (shown by the red dashed line in the chart). Especially, the degree of the reliability of Patient Satisfaction (α = 0. 88) is significantly higher than others, which means it gets higher internal consistency of responded data. AI-Powered Nanobot Effectiveness also depicts a reasonable reliability estimate at 0. 82 while IoT System Usage though slightly lower at 0. 75 can be deemed reasonably reliable (Shafik et al., 2024).

Correlation Analysis

The correlation matrix (Table 3) reveals a positive correlation, where the coefficient of determination is equal to 0. 68, which defines the highly positive relationship between AI Nanobot Effectiveness and Patient Outcomes showing the direct positive relationship where the AI nanobots enhance the patient health outcome. The Patient Satisfaction results are also moderately positively correlated with the IoT System Usage and, in particular, equal to r = 0. 57, which suggests that the Usage of IoT devices is positively associated with the satisfaction of patients. However, the mean of AI Nanobots and IoT System Usage is less strong for a correlation coefficient of 0. 41 which explains a mere moderate relationship between the two technologies (Srinivasan et al., 2024).

Regression Analysis

Table 4 shows that both AI Nanobot Usage and IoT System Usage are statistically significant and positive to patient satisfaction, and the p-value is less than 0. 001 and 0. 035, respectively. Comparing two types of technologies, the Beta Coefficients for AI nanobots are greater than IoT systems (0. 55 > 0. 33) indicating that AI nanobots have more impact on patients' clinical outcomes. The results reveal that the Patient Demographics control variable does not have any influence on the satisfaction, it reaffirms that the technology-driven interventions are the cause behind the improved results (Haghighi, Alizadeh, & Salehian, 2024).

Overall Interpretation

The studies presented prove that both the uses of AI-assisted nanobots and IoT systems will be significant in favor of improving individualized medicine for chronic conditions. It has been observed that AI nanobots have a more significant impact on patients, on the other hand, IoT systems have an average impact on the satisfaction of the patients. The reliability of the survey was found high, and thus the correlation values are quite strong which shows that the data does not contain much variability hence is valid to conclude that the interoperability of AI and IoT in chronic disease management could be highly beneficiary (Amit Singh & Shanker, 2024).

Discussion

In light of the above information, this study delivers important information on how AI nanobots and IoT when adopted may transform the future of chronic disease management and personalized medicines in the expected near future. The observed positive correlation between the resulting efficacy of the AI nanobots and patient results implies that AI nanobots may be beneficial in delivering the finest pinpoint accuracy that boosts efficiency in the treatment process hence better patient results. This is in agreement with previous literature that has identified nanotechnology in drug delivery and detection at the initial stages of diseases making the idea of AI-Nanobots a potentially revolutionary tool in Chronic Disease Management (Petrov, 2024).

The moderate positive relationship between the usage of IoT systems and patient satisfaction means that although IoT devices have the advantage of real-time monitoring and data capturing, these devices may require additional improvement in terms of user-friendliness or compatibility with additional technologies in the healthcare sector to engage the patients fully. While IoT devices are recognized for enabling perpetual health monitoring, depending on the results, patient satisfaction may vary based on how easy it is to use them, how safe their data is, and whether such devices can bring value by providing information for caregiving tailored to patients (Ciesla).

Interestingly, using regression analysis, it is found that both the AI nanobots and the IoT systems play quite an influential role in determining the satisfaction level of the patients, and where in this, the role of the AI nanobots seems to be even more prominent. This appears to imply that patients can attach value to superior treatment methodologies that on a one-on-one basis impact their physical well-being. As it was mentioned before, IoT technologies are slightly less influential in this case but still perform an essential role in providing the infrastructure for constant health monitoring, in addition to the presented information supporting the opinions on the potential of the combined use of both technologies in the field of personalized medicine (Shen, 2024).

Nevertheless, it is also possible to enumerate some study limitations, one of which is the non-normal distribution of IoT system usage data that may also mean that the variability in the perception or use of these systems may vary across the patient groups. This brings the argument to the argument that more research has to be conducted with an emphasis on the impact that various factors have on the adoption and success of IoT systems in the healthcare sector (Ciesla, 2024).

Conclusion

Therefore, this work proves the possibility of using nanobots and IoT technologies based on artificial intelligence in the further development of the concept of a personalized approach to chronic disease treatment. The very high positive correlation with patient health outcomes for the AI nanobot depicts the importance of the solution of increasing the accuracy and effectiveness of treatments in healthcare. Although less innovative, IoT systems offer relatively moderate improvements in offers real-time data acquisition for optimizing patient satisfaction and customized treatment.

Altogether, there is a stronger synergy between these two groups of technologies to address chronic diseases, creating an efficient opportunity to implement AI-based treatment processes coupled with IoT–supported long-term patient interaction. However, the fact that IoT system adoption and usability differ so significantly means that there is a need to conduct more research on how to improve IoT systems for use by patients and incorporate other Tech inventions.

In total, the results confirm the impact of AI and IoT in healthcare and stress the importance of further advancement and enhancement to enhance the opportunities in using AI and IoT systems to offer the most efficient and effective individual healthcare for chronic disease sufferers.

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