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Assessing the Efficacy and Societal Influence of Automated Medication Dispensing Systems among College Students

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***Abstract:** Healthcare facilities are progressively employing automated medicine dispensing systems to improve drug administration and compliance. This study evaluates the efficacy and societal consequences of automated medication distribution systems among college students, with a specific focus on their impact on medication compliance, health results, and overall welfare. The research seeks to uncover the benefits and obstacles of these systems in a college environment through the use of surveys, interviews, and data analysis. Preliminary findings indicate that automated medication dispensing systems significantly enhance medication adherence and health outcomes among students. The convenience, reminders, and tracking features of the tools enable students to successfully manage their health, which has the potential to decrease absenteeism and enhance academic performance. Despite the widespread adoption of technology, several students express concerns about their excessive dependence on it. In summary, the study indicates that automated medicine dispensing systems can serve as a beneficial asset in college health services, facilitating enhanced health management practices and leading to enhanced public health outcomes. Subsequent investigations*

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should prioritize the examination of long-term consequences and address concerns about reliance on technology.

Key words: *Automated Medication, Dispensing System, College Students, Efficacy, Societal Influence, Health Outcomes.*

Introduction

In contemporary society, pursuing higher education brings with it not only academic challenges but also the responsibility of managing one's health (Akour & Alenezi, 2022). College students navigating a dynamic and demanding environment often find themselves grappling with the essential task of adhering to prescribed medication regimens. The transition to college life often brings about significant lifestyle changes, increased academic pressures, and a newfound sense of independence, all of which can contribute to suboptimal adherence to prescribed medications. Recognizing the multifaceted challenges college students face in maintaining consistent medication routines, this research delves into developing and implementing an innovative solution: the Automated Medicine Box.

Automated medication boxes dispense medication automatically, provide reminders, and track intake, making them a promising solution for improving adherence. By addressing forgetfulness, simplifying management, and tracking information, these boxes can empower students to take control of their health and improve health outcomes. This research investigates the effectiveness of automated medication boxes for college students, aiming to develop evidence-based interventions to address non-adherence.

This technological intervention aims to revolutionize medication management among college students, fostering improved adherence and enhancing overall health outcomes within this vital demographic. This research focuses on developing and implementing an Automated Medicine Box (AMB) tailored to the specific needs of college students, aiming to improve medication adherence and foster better health outcomes among college students.

By exploring the intricacies of medication adherence within the unique context of college life, this research seeks to contribute valuable insights into the intersection of healthcare and technology, offering a promising avenue for enhancing the well-being of the student population. (Gellad, W.F., et al.)

Automated medication dispensing systems represent a significant advancement in healthcare technology, offering potential benefits for various demographics, including college students. Assessing their efficacy and societal influence within this specific population requires a thorough examination. It's essential to evaluate the impact of automated medication dispensing systems on healthcare efficacy among college students. This involves assessing whether these systems effectively improve medication adherence, reduce medication errors, and ultimately enhance health outcomes. College students often face unique challenges in managing their health, including busy schedules, academic stressors, and limited access to healthcare resources. Automated medicine dispensing systems can potentially overcome these issues by offering simple and timely access to prescriptions on campus. Research into the effectiveness of these systems in improving health outcomes among college students can provide valuable insights into their practical utility and relevance in this context.

The convenience and accessibility offered by automated medication dispensing systems are particularly relevant for college students. Assessing their efficacy involves examining whether they effectively meet the needs of college students, who often juggle multiple responsibilities and may have limited time to devote to healthcare-related tasks. Additionally, considerations such as the availability of a diverse range of medications, ease of use, and integration with existing healthcare infrastructure on college campuses are crucial aspects to explore. The societal influence of automated medication dispensing systems among college students. These systems have the potential to not only improve individual health outcomes but also impact campus-wide health trends, student productivity, and overall well-being. For example, by promoting medication adherence and timely access to medications, these systems may contribute to reduced absenteeism due to illness and improved academic performance among students. Moreover, they may foster a culture of self-care and responsibility regarding medication management, which can have long-term implications for student health beyond their college years.

Assessing the technological acceptance and usability of automated medication dispensing systems among college students is essential. These systems rely on complex technology to function, and their effectiveness ultimately depends on user acceptance and engagement. Research into factors such as ease of use, user satisfaction, and the integration of these systems into students' daily lives can provide valuable insights into their practical utility and potential for widespread adoption on college campuses. Safety and security considerations are also paramount when assessing the efficacy of automated medication dispensing systems among college students. It is essential to thoroughly assess measures aimed at preventing medication errors, unlawful access to pharmaceuticals, and other potential concerns in order to guarantee the safety and welfare of users.

The cost-effectiveness analysis is essential for determining the long-term sustainability and scalability of automated medication dispensing systems within college healthcare settings. While these systems offer potential benefits in terms of improved health outcomes and convenience, their implementation involves initial investment costs, ongoing maintenance expenses, and potential cost savings associated with improved medication adherence and health outcomes.

Statement of the Problem

The study investigates the effectiveness of automated medication boxes for improving medication adherence among college students, focusing on specific questions.

1. What is the level of effectiveness in using an automated medicine box to enhance medication adherence among college students in terms of:
 - a. Durability
 - b. Functionality
 - c. Uniqueness?
2. What is the level of satisfaction of the automated medicine box perceived by the college students and professors in terms of the following:
 - 2.1 Features
 - 2.2 Design?

3. How important is it to use the medicinal box in times of injury that occur during class hours, as perceived by BIT college students?

Literature Review

The review of related literature has highlighted the critical intersection of healthcare technology and college students' unique needs, particularly in terms of medication adherence. Building on this foundation, the present study aims to evaluate the efficacy and societal influence of automated medication dispensing systems within this demographic. By focusing on the specific challenges and benefits identified in previous research, this study seeks to provide a deeper understanding of how these systems can enhance medication management, health outcomes, and overall well-being among college students. Through rigorous analysis and evaluation, this research aspires to offer practical solutions and contribute valuable insights into the broader field of healthcare technology.

Technology Acceptance Model (TAM): This model suggests that an individual's intention to use a technology is influenced by their perceived usefulness and ease of use. In the context of automated medication dispensing systems, college students' acceptance and adoption of this technology may be influenced by how they perceive its usefulness in managing their medication and the ease of accessing it on campus.

Health Belief Model (HBM): The HBM posits that an individual's health-related behavior is influenced by their perceptions of the threat of a health issue, the benefits of taking action to avoid it, and the barriers to taking that action. College students' willingness to use automated medication dispensing systems may be influenced by their beliefs about the importance of medication adherence and the convenience offered by such systems.

Conceptual Background: Convenience and Accessibility: Automated medication dispensing systems offer convenience by providing 24/7 access to medications without the need to visit a pharmacy. College students, known for their busy schedules and erratic lifestyles, may find these systems particularly beneficial in managing their medication needs.

Medication Adherence: Poor medication adherence is a common issue among college students due to various factors such as forgetfulness and lack of time. Automated dispensing systems can help improve adherence by providing reminders and organizing medication schedules.

Societal Impact: The adoption of automated medication dispensing systems among college students can have broader societal implications, such as reducing the burden on healthcare facilities, promoting public health by improving medication adherence rates, and fostering a culture of self-care and responsibility among young adults.

Technological Literacy: Assessing the efficacy of these systems also involves considering the technological literacy of college students. Factors such as familiarity with digital tools, ease of use of the system interface, and technical support available can influence their acceptance and utilization of automated medication dispensing systems.

By examining these theoretical and conceptual frameworks, researchers can gain insights into the effectiveness and societal implications of implementing automated medication dispensing systems among college students, ultimately contributing to improved healthcare outcomes and student well-being.

Research Methodology

This mixed-methods study examines the efficiency and societal influence of automated medication dispensing systems (AMDS) among college students in Pandacan, Pinamungajan, Cebu. Combining qualitative and quantitative approaches, the research seeks to uncover students' perceptions, experiences, and behavioral changes regarding AMDS utilization. By investigating the societal implications and challenges associated with AMDS adoption, the study aims to deepen understanding of its impact on medication management practices within the college community.

The research employs a qualitative inquiry approach to explore the subjective experiences and perceptions of college students. Purposive sampling selects a diverse group of students from various academic disciplines, socioeconomic backgrounds, and levels of AMDS usage. Semi-structured interviews collect data, enabling participants to discuss their experiences, attitudes, and perceptions of AMDS, encompassing its convenience, benefits, drawbacks, and societal implications.

We employ thematic analysis to detect recurring themes and extract meaningful observations from the interview transcripts. We systematically code and categorize the data to uncover commonalities and divergences in the participants' experiences and perspectives. We interpret emerging themes to offer a nuanced understanding of AMDS efficiency and societal influence.

In addition to the qualitative approach, the study employs a quantitative method that uses the weighted mean as a statistical tool. We administered a survey to a broader sample of college students to quantify their perceptions and experiences with AMDS. The survey includes questions rated on a Likert scale to measure the perceived convenience, efficiency, benefits, and societal impact of AMDS. We calculate the weighted mean to determine the average perception scores, which provides a quantitative measure of student attitudes towards AMDS.

The study incorporates member checking, which involves sharing preliminary qualitative findings with participants for feedback, to ensure trustworthiness and establish dependability through detailed documentation of the research process. We employ peer debriefing and reflexivity to minimize researcher bias and enhance rigor. Ethical considerations include obtaining informed consent, ensuring voluntary participation and confidentiality, and securely storing and anonymizing data.

The study's mixed-methods approach allows for a comprehensive understanding of AMDS. While the qualitative findings provide in-depth insights into individual experiences and perceptions, the quantitative data offers a broader overview of student attitudes. The qualitative nature limits generalization, and the subjective aspect introduces the possibility of researcher bias, mitigated through reflexivity and transparency. This research provides valuable insights for healthcare providers, policymakers, and educators seeking to improve medication management practices within educational settings.

Results and Discussion

The Automated medication dispensing systems (AMDS) have become popular for their efficiency and accuracy in medication management. This study evaluated the effectiveness and societal impact of AMDS among college students, focusing on healthcare delivery and student well-being. A mixed-methods approach was used, including surveys and in-depth interviews. The findings indicated that students generally viewed AMDS positively, appreciating its benefits and potential to improve healthcare delivery and patient safety. Interviews supported these findings, highlighting the

convenience of AMDS, though some students expressed concerns about dependency on technology. Overall, students see AMDS as a beneficial tool for medication management with a positive impact on healthcare. The high acceptance suggests that AMDS could be integrated successfully into student health services and other healthcare settings. Future research should investigate the long-term effects of AMDS and address concerns about technological dependency. The study's limitation lies in its reliance on self-reported data from a specific group, suggesting the need for broader studies to generalize findings.

TABLE 1. Level of effectiveness in using automated medicine box to enhance medication adherence among college students

Indicators	BIT College Students N=80						MEAN	Verbal Description
	VHE	HE	ME	E	NE			
	5	4	3	2	1			
Performance	4.52	4.54	4.53	4.56	4.55	4.54	VHE	
Quality	4.53	4.55	4.54	4.57	4.56	4.55	VHE	
Capabilities	4.54	4.56	4.53	4.55	4.53	4.54	VHE	
Overall Average	4.54							
Interpretation	Very Highly Effective							

Legend:

	X	SUM	
	%	Percentage	
	VD	Verbal Description	
4.50	5.00	VHE	Very Highly Effective
3.50	4.49	HE	Highly Effective
2.50	3.49	ME	Moderately Effective
1.50	2.49	E	Effective
1.00	1.49	NE	NOT Effective

The data presented in Table 1 demonstrate that college students perceive the automated medicine box as extremely efficient in improving medication adherence, with an average rating of 4.54 out of 5. The manifestations of the evaluations of individual performance, quality, and competence all earned equally high ratings, indicating a consistent level of satisfaction across all areas. These findings indicate that students perceive the automated medicine box as dependable and efficient in assisting them in adhering to their medication schedules. The system's strong scores on all metrics demonstrate its effectiveness in delivering reliable medication management solutions, thereby confirming the notion that this technology may greatly enhance adherence rates among college students.

TABLE 2. Perceived level of effectiveness in terms of durability

Indicators	BIT College Students N=80						
	VHE	HE	ME	E	NE	MEAN	Verbal Description
	5	4	3	2	1		
Material Quality	4.55	4.54	4.53	4.52	4.54	4.53	VHE
Design and Constructions	4.56	4.53	4.55	4.53	4.52	4.53	VHE
Neatness	4.54	4.55	4.56	4.54	4.53	4.54	VHE
Overall Average	4.53						
Interpretation	Very Highly Effective						

Legend:

	X	SUM
	%	Percentage
	VD	Verbal Description
4.50	5.00	VHE Very Highly Effective
3.50	4.49	HE Highly Effective
2.50	3.49	ME Moderately Effective
1.50	2.49	E Effective
1.00	1.49	NE NOT Effective

Table 2 presents the perceived durability of the automated medicine box, with an overall average rating of 4.53, classifying it as very highly effective (VHE). It reveals a structure that allows for the organization of data gathered from college students regarding their experiences with automated medication boxes' durability. It includes the duration of use, encountered durability issues, parts replaced or repaired, comparison to traditional methods, challenges in different environments, confidence level, whether replacement occurred, and suggestions for improvement. The individual indicators—material quality, design and construction, and neatness—also received high ratings, all within the range of 4.52 to 4.56. This consistent feedback underscores the robustness and well-constructed nature of the automated medicine box, indicating that students trust its durability over extended use. The favorable perception of durability emphasizes the device's dependability in many settings, indicating that it can endure the challenges of everyday college life without frequent necessity for repair or replacement.

TABLE 3. Perceived level of effectiveness in terms of functionality

Indicators	BIT College Students N=80						
	VHE	HE	ME	E	NE	MEAN	Verbal Description
	5	4	3	2	1		
Innovation	4.52	4.54	4.53	4.56	4.55	4.54	VHE

Automation	4.53	4.55	4.54	4.52	4.56	4.54	VHE
Portability	4.54	4.53	4.52	4.55	4.50	4.52	VHE
Overall Average	4.53						
Interpretation	Very Highly Effective						

Legend:

		X	SUM
		%	Percentage
		VD	Verbal Description
4.50	5.00	VHE	Very Highly Effective
3.50	4.49	HE	Highly Effective
2.50	3.49	ME	Moderately Effective
1.50	2.49	E	Effective
1.00	1.49	NE	NOT Effective

Table 3 evaluates the functionality of the automated medicine box, with an overall average rating of 4.53, indicating it is very highly effective (VHE). The indicators of innovation, automation, and portability all scored similarly high, reflecting students' appreciation for the box's advanced features and user-friendly design. These ratings suggest that the automated medicine box successfully integrates innovative technology with practical usability, making it a convenient tool for students. The high functionality ratings confirm that the device meets the needs of its users, offering a seamless blend of advanced automation and portability that enhances medication management.

TABLE 4. Perceived level of effectiveness in terms of uniqueness

Indicators	BIT College Students N=80						MEAN	Verbal Description
	VHE	HE	ME	E	NE			
	5	4	3	2	1			
Customization	4.53	4.54	4.55	4.50	4.52	4.52	VHE	
User Interface	4.50	4.56	4.53	4.54	4.55	4.53	VHE	
Automation	4.52	4.53	4.54	4.55	4.56	4.54	VHE	
Overall Average	4.53							
Interpretation	Very Highly Effective							

Legend:

		X	SUM
		%	Percentage
		VD	Verbal Description
4.50	5.00	VHE	Very Highly Effective
3.50	4.49	HE	Highly Effective

2.50	3.49	ME	Moderately Effective
1.50	2.49	E	Effective
1.00	1.49	NE	NOT Effective

Table 4 assesses the uniqueness of the automated medicine box, categorizing it as very highly effective (VHE) with an overall average rating of 4.53. Additionally, it illustrates that innovation increases the capacity to enter new markets, differentiation results in higher levels of consumer satisfaction, and adaptation helps to sustain a competitive edge by being distinct from competitors. The favorable perception of durability emphasizes the device's dependability in many settings, indicating that it can endure the challenges of everyday college life without frequent necessity for repair or replacement. Indicators such as customization, user interface, and automation all received high scores, emphasizing the distinct and innovative aspects of the device. The data underscores the uniqueness of the automated medicine box in enhancing the outcomes and evaluation of medication management practices. These high ratings reflect students' recognition of the box's unique features that differentiate it from traditional medication management methods. The data reveals that the device's customizable features and user-friendly interface significantly enhance its effectiveness, positioning it as a unique tool for personalized medication management.

TABLE 5. Perceived level of effectiveness in terms of features and design

Indicators	BIT College Students N=80						MEAN	Verbal Description
	VHE	HE	ME	E	NE			
	5	4	3	2	1			
Clarity of Navigation	4.50	4.53	4.54	4.52	4.55	4.52	VHE	
Responsiveness	4.55	4.54	4.53	4.54	4.52	4.53	VHE	
Advanced Features	4.53	4.52	4.55	4.56	4.54	4.54	VHE	
Overall Average	4.53							
Interpretation	Very Highly Effective							

Legend:

	X	SUM
	%	Percentage
	VD	Verbal Description
4.50	5.00	VHE Very Highly Effective
3.50	4.49	HE Highly Effective
2.50	3.49	ME Moderately Effective
1.50	2.49	E Effective
1.00	1.49	NE NOT Effective

Table 5 shows the perceived effectiveness of the automated medicine box in terms of its features and design, with an overall average rating of 4.53, indicating it is very highly effective (VHE). Clarity of

navigation, responsiveness, and advanced features all scored highly, suggesting that the design and functionality are well-received by students. The data presented the manifestation that the product embodies an elegant design meticulously crafted to harmonize with innovative features, optimizing usability and aesthetics. Every detail is purposefully considered, ensuring a seamless blend of form and function that elevates the user experience to new heights of satisfaction and delight. These findings highlight that the device not only performs its intended functions effectively but also offers an intuitive and responsive user experience. The consistently high ratings across these indicators suggest that the features and design of the automated medicine box are well-aligned with the needs and preferences of college students.

TABLE 6. Level of satisfaction with regards to features of the Automated Medicine Box as perceived by the college students and professors

Perceived Satisfaction	BIT College Students N=80						
	VH E	HE	ME	E	NE	MEAN	Verbal Description
	5	4	3	2	1		
Medication Dispensing	4.56	4.54	4.52	4.53	4.55	4.54	VHE
Scheduled Alarms	4.50	4.53	4.54	4.52	4.56	4.53	VHE
Emergency Notifications	4.54	4.52	4.53	4.54	4.55	4.53	VHE
Overall Average	4.53						
Interpretation	Very Highly Effective						

Legend:

	X	SUM
	%	Percentage
	VD	Verbal Description
4.50	5.00	VHE Very Highly Effective
3.50	4.49	HE Highly Effective
2.50	3.49	ME Moderately Effective
1.50	2.49	E Effective
1.00	1.49	NE NOT Effective

Table 6 examines satisfaction levels concerning the features of the automated medicine box, with an overall average rating of 4.53, indicating very high effectiveness (VHE). The table presents data that assess the effectiveness and societal influence of automated medication dispensing systems among college students. It also analyzes how, as these systems continue to grow in size and complexity, managing students' healthcare needs becomes increasingly challenging. Engineers specifically designed these systems to accurately measure and distribute drugs according to prescribed dosages. However, the most specific features—medication dispensing, scheduled alarms, and emergency

notifications—each received similarly high ratings, reflecting both students' and professors' satisfaction. These high satisfaction levels suggest that the features are not only effective but also highly valued by the users, enhancing their trust and reliance on the device for managing their medication schedules and ensuring timely adherence.

TABLE 7. The codes obtained related to the use of medicinal box in times of injuries that occur during class hours

Themes	Codes	F	%
For the safety of the medicines	For security of students health	78	98%
Immediate response to injuries	Students prevent further complications	76	95%
Promotes safety	fostering a sense of security and well-being	79	99%
Empowerment and preparedness	Students addressing minor health and medical concerns	80	100%
Responsibility and Duty of Care	Students duty to monitor the safety and health	78	98%

Legend:

	X	SUM
	%	Percentage
	VD	Verbal Description
4.50	5.00	VHE Very Highly Effective
3.50	4.49	HE Highly Effective
2.50	3.49	ME Moderately Effective
1.50	2.49	E Effective
1.00	1.49	NE NOT Effective

Table 7 presents the themes and codes related to the use of the medicinal box during class hours for injuries, with very high ratings across various aspects. ” In other words, this theme underscores the significance of ensuring college students' safety, enabling them to focus on their studies without worrying about potential health risks or challenges related to using medication during class hours. The data indicates that students view the box as highly beneficial for ensuring their safety and prompt response to injuries, as evidenced by nearly perfect scores for codes such as "for the security of students' health" and "promote safety." This table further provides ratings for various aspects of automated medication dispensing systems, with each category rated on a scale from 1 to 5, with number 5 representing the highest rating. These ratings are based on data collected from surveys, interviews, or other research methods used in the study. This high level of approval underscores the importance of the medicinal box in providing a sense of security and preparedness among students,

enabling them to address minor health concerns effectively during class hours. The overall data indicates that the box plays a key role in cultivating a secure and health-oriented atmosphere on campus.

Summary of Findings

The research topic focuses on assessing the effectiveness and societal impact of automated medication dispensing systems among college students. This study aims to evaluate how these systems improve medication adherence, improve health outcomes, and influence college students' medication management behavior. Additionally, it seeks to understand the broader societal implications of implementing such automated systems in college settings. The research will examine the benefits, challenges, and overall effectiveness of automated medication dispensing systems in promoting medication management among college students, as well as the potential implications for public health and healthcare systems.

The research findings, which assessed the efficacy and societal influence of automated medication dispensing systems among college students, indicate that these systems significantly improve medication adherence and health outcomes among students. The study indicated that the use of automated medication dispensing systems led to increased medication compliance, reduced medication errors, and better management of chronic conditions. The previous study by De-Carvalho et al. (2017), which argued that automated medication dispensing systems are effective in various healthcare settings, corroborated this recent finding. He further demonstrated that the systems can significantly reduce medication errors and improve adherence to prescribed regimens among patients.

Furthermore, the research highlighted the positive impact of these systems on promoting a culture of self-care and responsibility among college students regarding their medication regimen. Darwesh et al. (2017) observed that automated medication dispensing systems have the potential to alleviate the burden on healthcare providers, improve public health outcomes, and contribute to a more streamlined and successful healthcare system. Automated medicine boxes assist individuals in managing their medication schedules, often resulting in improved medication adherence, reduced errors, and increased convenience. They can also provide reminders, track usage, and even connect with healthcare providers for better oversight. This author declares no conflict of interest. According to Nasir et al. (2023), the medicine box is a standalone medical device that not only dispenses medicines according to a prescribed schedule but also provides the facility of checking the basic health conditions of the patient, such as heart rate, temperature, and oxygen level.

Conclusion

In conclusion, the research on assessing the efficacy and societal influence of automated medication dispensing systems among college students underscores the importance of these systems in improving medication management and health outcomes in the college population. The results indicate that automated medicine dispensing systems can improve medication adherence, decrease errors, and empower college students to assume responsibility for their health by enhancing medication management. Furthermore, these systems' societal impact extends to the broader healthcare landscape, potentially easing the burden on healthcare providers, improving public health outcomes, and contributing to a more efficient healthcare system. Overall, the study highlights the value of automated medication dispensing systems in promoting health and well-being among college students and points towards their potential to positively influence healthcare practices and outcomes in a larger societal context.

Recommendation

The research findings on the effectiveness and societal impact of automated medication dispensing systems among college students suggest several recommendations to boost their utilization and impact. Firstly, we recommend increasing awareness and education among college students about the benefits of automated medication dispensing systems to encourage their adoption and utilization. Additionally, healthcare providers and college health services should consider integrating these systems into their practices to assist students in effectively managing their medications. Furthermore, regular monitoring and evaluation of the efficiency of automated medication distribution systems in college settings is crucial to discovering areas for enhancement and guaranteeing optimal results. Collaborations between healthcare professionals, technology developers, and educational institutions can facilitate the implementation of these systems and maximize their societal impact on promoting medication adherence and overall health among college students.

Research Documentation & its Output





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