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Integrating QVoC (QR Code with Voice Content) to Enhance Medication Adherence for Geriatric Diabetic Patients

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ABSTRACT

Medication compliance is a top-of-mind factor for effective diabetes care, particularly in elderly groups that typically suffer from cognitive, social, and technological barriers. This research sought to establish the impact of incorporating QR Code with Voice Content (QVoC) technology on medication compliance among geriatric diabetic patients in Barangay Morales, Koronadal City. Using a quasi-experimental design, the researchers

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recruited 20 older diabetic patients through purposive sampling. The intervention was a QVoC device that provided audio cues linked to QR codes for targeted drugs, which were designed to address forgetfulness and complexity in medication regimens. Medication adherence data were collected using a validated questionnaire derived from the Morisky Medication Adherence Scale (MMAS) pre- and post-intervention. The adherence mean score increased from 2.95 (SD = 0.18) before intervention to 3.70 (SD = 0.09) after intervention. Participants reported better comprehension, increased regularity in drug taking, and reduced omitted doses errors. The conclusion drawn by the study was that QVoC is helpful, easy, and very effective technology-based treatment for improving medication adherence among elderly diabetic patients. Future research can explore the long-term outcomes and scalability of such interventions across different populations.

Keywords: medication adherence, geriatric diabetes, QVoC, QR code intervention, digital health, elderly care, chronic disease management

INTRODUCTION

Background of The Study

Medication adherence is a critical issue, especially among the elderly, where the prevalence of chronic conditions such as diabetes is on the rise. The effective management of diabetes depends on consistent medication adherence, yet studies indicate alarmingly low rates among geriatric patients. Such statistics are evidenced as, for instance, in one study conducted on patients suffering from type 2 diabetes in Yemen, it shows that only about 47.75% are adherent, while in similar studies conducted at Pakistan, approximately 55.6% showed adherence among aged hypertensive (Othman et al., 2020; Saqlain et al., 2019). Reasons include low health literate, lack of memory among the patients for taking drugs due to complicated intake regimen, economic and social problem (Yazdanpanah et al., 2019).

Diabetes Mellitus is an overwhelming issue considering health outcomes and quality of life in general and particularly in the aging population globally. According to International Diabetes Federation, as of 2021, around 536.6 million adults aged between 20-79 years have diabetes, projecting the number up to 783.2 million people in 2045, where most of it will be continued to stay low and middle income (IDF, 2021). Philippines Cross-sectional survey results indicated almost 20.5% diabetes prevalence among old people (Abas et al., 2022). This reflects most parts of Southeast Asia where lifestyle factors combined with limited access to healthcare explain high diabetes rates often surpassing 20% (Mendes et al., 2019).

Although diabetes is common and widespread, it is still challenging in terms of adherence to medications. Cognitive factors like anxiety and depression negatively impact adherence and self-care activities (Mendes et al., 2019). Studies have documented several reasons why the elderly suffer from poor adherence regarding diabetes treatment, including having complicated drug regimens and a lack of support system (Jannoo & Khan, 2019). These comparisons within the Philippines and other countries in the ASEAN community further emphasize challenges of geriatric patients because of the socio-economic inequalities and differing health literacy (Abas et al., 2022).

This makes urgent the need for targeted interventions for enhancing medication adherence among geriatric diabetic patients since there are marked gaps in knowing the specific factors that influence medication adherence in low- and middle-income countries, such as the Philippines. Since studies have shown general challenges about medication adherence, more comprehensive investigations must be done that would look at the interplay of cognitive, emotional, and socio-economic factors within this population group.

An immediate concern on the medication non-adherence problem on elderly diabetic patients in Koronadal City. The adherence of the majority to their treatment today is only fifty percent for patients of type 2 diabetes, alarming statistics today and a hindrance to good control of the patient's diabetic health, along with severe health consequences and unnecessary higher healthcare cost expenses.

The new approach to knowledge and medication adherence among geriatric diabetic patients, proposed in this study, involves the integration of QVoC, or QR Code with Voice Content. Easy access to medication instructions

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and health information through QR codes linked to voice content may help overcome some of the barriers that low health literacy and cognitive challenges often create for elderly patients.

This research goes further than just patients directly involved with the disease in that its outcomes will be instrumental in guiding care providers in crafting interventions to support better adherence with medication regimens, thereby better managing the disease and the cost of medical complications resulting from non-adherence. It may also help guide public health programs for the better management of adherence in older people, with resulting health benefits in a population as a whole.

REVIEW OF RELATED LITERATURE AND STUDIES

Importance of Medication Adherence

Brodie, Madden, and Rosen (2020) mentioned the new applications of Quick Response (QR) codes in medication education as their capacity to enhance patient understanding and adherence to drug therapy. Educating resources available with QR code usage offers access to teaching video and ancillary materials at patient fingertips, expounding on instructions for medications as well as medical information. Such a method not only promotes enhanced patient involvement but also helps in tackling issues caused by low health literacy, especially by older generations of people who may find conventional written information difficult. Such technology has the potential to greatly enhance adherence to medication through enabling patients to use tools necessary to take greater control over their own health.

Ti, Chen, and Wu (2020) came up with an advanced visual cryptography-based QR code system specifically designed to optimize drug administration. This technology enhanced drug administration security and usability, ensuring that access to sensitive information about drug doses and time will only be available for trained personnel. The use of QR codes minimizes administration errors, traditionally inherent in medication manual handling. This technology does not only expedite medication administration but also helps patients adhere to treatment more reliably by providing clean and secure entry to their medical data, bettering health results eventually.

Svensk and McIntyre (2021) explored the use of QR code technology as one way for elimination of medication error through self-administration. Research demonstrated that addition of QR codes on packages for medications makes patients able to read codes for getting immediate access to simple-to-read directions on the proper application and dosage. Prompt availability minimizes misunderstandings and misadministration, particularly among patients of older age and with impaired mental acuity or complex treatment regimens. These interventions in technology are essential to maximize medication compliance levels and help patients comply with their prescribed regimen accordingly.

Karia, Hughes, and Carr (2019) presented a scoping review of how QR codes have been used within healthcare education with mention of enhancing the understanding by patients of information relating to health. The article discussed a number of applications of QR codes within learning environments, where they have been used to link patients to multimedia content offering feedback on treatment protocols and drug regimens. Simplification of health information in ways accessible through interactive content significantly raises the compliance levels of patients having different levels of health literacy. Further research is suggested for identifying the success of QR code technology as a tool for educating and empowering the patient in treating chronic disease.

Boonyapalanant, Ketcham, and Piyaneeranart (2020) presented a creative use of QR code technology toward the objective of concealing patient injury information inside images in medicine. As much as it is focused on privacy concerns, this article shows evidence of the versatility of QR codes in healthcare settings. Including QR codes in medical records or imaging systems adds confidentiality while making necessary information about their treatment plans available to patients. Double functionality aids in better adherence through enabling patients to interact with their health data in a secure manner while reducing risks of unauthorized use of sensitive data.

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Factors Influencing Medication Adherence

A prevalence of medication non-adherence of 19.9% was found in a study by Xu, et al. (2020) with strong associations between non-adherence and variables such as gender—in females, the patients had greater probability of being non-adherent—and the significance placed on medication adherence which had an inverse correlation with adherence rates. Longer duration of disease is also found to be positively correlated with improved adherence. Therefore, disease experience may improve the understanding and adherence of the treatment regimen. Therefore, these findings indicate that the necessity for specific interventions like counseling and educational programs would increase awareness regarding medication adherence among elderly diabetic patients and enhance their self-management and health outcomes.

A revised overview of the factors that influence medication adherence among patients suffering from chronic physical diseases, including diabetes, is available in the work of Gast

and Mathes (2019). They learned that drug compliance is a multifaceted issue with various dimensions that are classified into five broad categories: social and economic factors, therapy factors, disease factors, patient factors, and items related to the healthcare system. The authors emphasized that the identification of patients at high risk for non-adherence and the development of specialized therapies to enhance adherence relies on an understanding of these contributing factors. For instance, they note that unintentional non-adherence often results from forgetfulness or cognitive impairment, but intentional non-adherence can be the result of conscious decisions based on costly prescription medications or complex treatment regimens.

Wilhelmsen and Eriksson (2019) reported a thorough assessment of medication compliance programs and how effective they are, particularly when dealing with diseases such as diabetes. They learned that successful efforts to enhance diabetic patients' compliance with their medication often involve employing a variety of strategies, including the use of technology, changes in behavior, and education campaigns. The authors emphasized that educational interventions are particularly critical as they enable patients to better understand their prescription regimens and highlight just how crucial adherence is to effectively be managing diabetes. Additionally identify a series of significant factors that influence drug adherence. These are the complexity of treatment regimens, which can discourage patients from adhering to their medications, and the efficacy of social support from loved ones and physicians.

Stewart, Moon, and Horne's (2023) essay provided a comprehensive review of pharmaceutical nonadherence, with a focus on its health impacts, prevalence, associations, and potential solutions. In the view of the authors, drug nonadherence is a significant public health issue whose implications fall on treatment outcomes and increase morbidity and medical costs. They highlighted that approximately 800 unique factors contribute to adherence behavior, from the systemic level such as access to care and prescription expenses to patient- related factors such as psychological and health literacy.

Anderson et al. (2020) emphasized the need for adherence in the proper management of diabetes by systematically reviewing medication adherence programs and their impact on diabetic patients. The researchers found that strengthening medication adherence is important to improving glycemic control and reducing diabetes-related complications such as renal failure and cardiovascular illness. They emphasized that not following the instructions when taking prescription medicines can have unfavorable health consequences such as increased hospitalization and health costs. Several effective interventions that have been proven to enhance medication adherence among diabetes patients are enumerated by Anderson, et al. (2020). They include strategies such as patient education programs that offer patients information on their condition and the treatments that can be offered, and simplification of dosing, which simplifies pharmaceutical regimens.

To illuminate the significant effects of medication adherence on patient health outcomes, Kvarnström, et al. (2021) analyzed the determinants of medication adherence among patients with chronic diseases. The authors emphasized that regular use of medication can lead to improved glycemic control, fewer issues, and a better quality of life, particularly in chronic diseases such as diabetes, where medication adherence is crucial for effective disease management. They learned that noncompliance could produce adverse health results, including disease progression, longer hospitalizations, and higher costs of medical care. The authors note that whether a

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patient takes drugs depends largely on the patient's perception of drugs; for example, patients tend to miss doses or discontinue treatment altogether when they believe that their drugs will not work or have undesirable side effects.

Levels of adherence were significantly affected by monthly income per Sendekie et al. (2022). Patients from lower incomes had trouble in meeting the cost of their prescription medicines, which was an immediate determining factor for adherence. The author asserts that increased education level for a patient had a correlation with improved medication regimen and understanding leading to improved adherence. Knowledge regarding diabetes and managing it was fundamental. In addition, elderly individuals often have cognitive impairment that can greatly interfere with their remembering prescription regimens and understanding treatment plans. As a result, individuals with greater cognitive ability are more likely to adhere to taking their medications as directed, studies indicate.

Several factors affect medication adherence among older diabetes patients with follow- up treatment, according to Demoz et al. (2019). The level of understanding regarding diabetes treatment and medication is crucial. Patients who are more aware of their condition and the importance of adhering to their medication are more likely to continue with adherence. This category can be helped through educational interventions that enhance their understanding and self-management skills. Financial issues have a strong influence on medication adherence. Poorer patients often struggle with paying for prescription medications, resulting in them dropping doses or withdrawing from therapy entirely. Adherence can be strengthened by overcoming such financial barriers.

Patient Experiences with Medication Adherence

Religious individuals who are strong are more likely to adapt with ease managing their diabetes, and this is attributed to greater compliance with prescription regimes, as stated in the Saffari et al. (2019) article. This association suggests that a patient’s compliance with prescribed treatments may be aided by religious coping styles such as volunteering and prayer. In addition, the researchers found that social support is a significant mediating variable, implying that having supportive others can further enhance drug compliance. The authors suggest an integrated approach to diabetic patients' medication compliance, incorporating social support and religious coping strategies into diabetes treatment plans.

Religious beliefs can be a powerful motivator for diabetic patients to adhere to their medication, as stated by the Onyishi et al. (2022) journal. Individuals are more likely to prioritize their treatment when they feel that it is their religious duty to maintain their health. Improved glucose control and overall health outcomes may be achieved through consistent medication intake triggered by this feeling of responsibility. Religion positively influences mental health, which is important in terms of controlling diabetes, according to the authors. Religious patients are often reported to experience less depression and anxiety, two conditions that could make medication difficult to manage as directed.

The article by Onyishi et al. (2022) reveals that religious beliefs have a significant impact on medication adherence among diabetic patients. The authors point out that people who are more religious tend to have better health outcomes because they are intrinsically motivated to manage their health as part of their spiritual beliefs, which encourages patients to follow their prescribed medication regimens more closely. They also stress that faith can instill a sense of duty in patients to care for their health, which leads to improved adherence to medication. When people see their health management as a spiritual obligation, they are more likely to prioritize taking their medications as directed.

Although the majority of participants claimed adherence to their prescription anti- diabetes medication, non-adherence is a critical issue, particularly in younger patients and less educated ones, as revealed by Afaya et al.'s (2020) article. This raises an issue with a demographic shortfall where younger patients are likely to find it harder to adhere to their prescription timetables compared to older patients. The study highlights the strong correlation of self-care measures like blood sugar control and management of diet and medication compliance. Effective self-care skills increase the likelihood of a patient following the medication regimen. The study further quotes that improper self-care behaviors are followed by most patients, which can have a negative effect on medication

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adherence.

As per Sahoo et al. (2022), various risk factors and lifestyle choices play a significant role in a diabetic patient's drug adherence. Only 34.14% of the subjects demonstrated good compliance with their prescribed anti-diabetic medication, revealing that drug adherence in diabetic patients is appalling. This poor compliance rate is alarming because it could lead to poor glycemic control and increase the risk of diabetes-related complications. The authors found that a 2.35-fold higher risk of non-adherence was associated with ongoing alcohol use. Alcohol may complicate the control of diabetes and make individuals more likely to forget taking their medications.

In line with the Mannan et al. (2021) article, a significant proportion of type 2 diabetes patients had not been in good medication adherence, showing a widespread public health concern. Approximately 46.3% of the patients did not adhere to their anti-diabetic medication as recommended, the researchers found. Increasing adherence rates is needed through individually tailored interventions, as this prevalence indicates. Mannan and co-workers found various sociodemographic factors associated with poor adherence. It was found that men were more likely than women to fail to follow through on their treatment regimens, which could mean that gender affects how patients engage with them.In addition, there were higher chances of non-adherence among poorer families, hence financial limitations may make it more difficult to obtain prescription drugs and healthcare.

The focus on medication compliance among diabetic patients is critical towards enhanced health outcomes and successful diabetes management, as stipulated by the Zhang et al. (2021) journal article. Zhang et al. (2021) suggest that to enhance glycemic control and reduce the risk of diabetes complications, diabetic patients need to prioritize medication adherence very highly. About 59.8% of patients, by the research findings, suffered from medication non-adherence, with direct implications to their health conditions. The medication adherence was, by the study, significantly determined by variables like self-efficacy and support; more especially, increased support led to high levels of social support that enabled increased self-efficacy resulting in better medication adherence.

According to the journal article published by LeRoith et al. (2019), diabetes, especially type 2 diabetes, is more common among people aged 65 years and above, which requires individualized management practices considering the intricacies of aging. They emphasize the need for personalized treatment targets that take into account patients' individual values and overall health, in addition to glycemic control. In a quest to ensure highest treatment results, the guidelines are supportive of involving a multidisciplinary team that includes endocrinologists and providers of diabetes care. The writers assert that special attention needs to be paid when evaluating the global health of individual patients as well as comorbidities before deciding the therapy extent in order to prevent medicine abuse in diabetics. They promote taking reasonable targets in glycemic as well as adopting individual patients' needs into account.

Interventions to Improve Medication Adherence

Extensive patient education was revealed to be the most effective therapy. This involves teaching individuals how to live with their diabetes, the importance of adhering to their medication schedules, and the science behind their actions. Educational sessions were often tailored to fit the needs of patients so that they could grasp their treatment programs (Presley et al., 2019). It has been shown that direct advice from a pharmacy significantly enhances drug adherence. Pharmacists explained patients' prescriptions to them, replied to questions, and provided advice on overcoming barriers to adherence. Patients were encouraged to follow their prescribed regimens, and confidence was increased through this tailored technique.

As Pouls et al. (2021) posit, tele-feedback through SMS or telephone calls was shown to be an efficient means of supporting habits of adherence. Through this strategy, healthcare professionals can monitor the progress of patients and offer help in real-time, helping in the solution of any arising issues. They suggest that another effective strategy discovered in the review is the integration of medication adherence care among medical practitioners. In order to prevent miscommunication and enhance compliance, one should ensure that all members of the healthcare team are communicating and caring for the patient in a similar manner. It is critical to enhance patient-to-health professional communication. Higher patient satisfaction and compliance can arise from interactive eHealth programs that provide forums where patients can speak up about concerns and ask

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questions about their medication.

Wiecek et al. (2019), interventions that used a lot of techniques were most often more effective than those which employed a single technique. This validates the argument that an integrated strategy would be necessary to address the complex nature of pharmaceutical non- adherence. Enhanced outcomes, for example, can be garnered by combining behavioral strategies, technology, and patient education. Governments can appropriate funds to develop and provide funding for multicomponent interventions that utilize behavioral strategies, technology, and patient education. These interventions can be tailored to suit patients' diverse needs, particularly those of elderly persons who may have severe challenges with drug management.

Medication adherence interventions and outcomes are critical components of effective healthcare provision, assert by Eriksson (2019). It has also been proven that nurse and pharmacist interventions are more effective than those made by general practitioners in promoting adherence and health outcomes. For this reason, pharmacists and nurses can increase patient comprehension and medication adherence by focused interaction and targeted training. It has also been proven that nurse and pharmacist interventions are more effective than general practitioner interventions in improving adherence and health outcomes. This means that nurses and pharmacists can enhance medication compliance and patient understanding by targeted interaction and targeted education.

To evaluate treatments for increasing medication adherence in older patients on multiple medications, Cross et al. (2020) conducted a systematic review. The research points to the importance of some of the therapies that address issues specific to individualized concerns of older patients such as cognitive problems, complex medication regimens, and the importance of effective communication with health professionals. Utilization of reminder systems to aid compliance, behavior and education interventions to enhance patient knowledge about medication and pharmacist-performed thorough medication reviews for regimen simplification and regimen complexity reduction are some of the important steps laid out. Multidisciplinary intervention, whose effectiveness lies in the establishment of a collaborative working of medical professionals to ensure patient-centered and customized interventions, is also highlighted as a component of the review.

Murali et al. (2019) have identified several effective strategies, such as cognitive- behavioral therapies that allow patients to effectively manage their treatment regimen and education programs that enhance patients' knowledge regarding their medication, as well as the importance of adherence. Technology-based interventions such as reminder systems and mobile applications were also noted for monitoring medication taking and providing reminders at appropriate times. Further, it was established that multidisciplinary teams of dietitians and pharmacists and collaborative care models are helpful in providing extensive support. To conclude, the review emphasizes that older patients with ESKD can improve medication adherence to a considerable extent by adopting a combination of behavioral, educational, and technological interventions, which will enhance their health outcomes.

Allemann et al. (2017) described that the overarching goal of efforts to reduce medication non-adherence in older patients is to make the interventions used and the profile of the patient match. Effective practices involve individualized education directed towards habituation with prescription regimens, simplification of dosing regimens to reduce complexity, and the use of reminder devices to remind patients about taking their medications. Use of multidisciplinary teams with doctors, nurses, and pharmacists can also improve communication regarding the treatment regimen and deliver comprehensive care.

Filipino Geriatric Diabetic Patients

Dimaporo et al. (2024) pointed out that among diabetic Filipino patients, particularly those who have had the disease for more than five years, exocrine pancreatic insufficiency (EPI) prevalence can be underappreciated. Especially in elderly individuals, who are at greater risk for both diabetes and pancreatic impairment, this underestimation can lead to severe medical conditions, like malnutrition and a compromised quality of life. To facilitate early detection and treatment, the authors recommend routine EPI screening of elderly diabetic patients. For Filipino patients, screening programs carried out in the community may be required because health awareness and access may differ. These programs should focus on educating patients and healthcare providers

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about the presentation and symptoms of EPI, including unexplained weight loss and gastrointestinal symptoms.

Exploring active ageing health determinants of working and retired Filipino elderly, de la Vega et al. (2021) informed the variables shaping their general wellness and health. This is relevant for elderly adults with diabetes given that, according to the findings revealed by the study, diabetes and other non-communicable diseases are very common among them. To promote active aging, the authors emphasize the importance of social support, lifestyle habits such as diet and exercise, and availability of healthcare services. All these are critical to effective diabetes management in older Filipino adults. The report indicates that community-based health programs focusing on diabetes education, regular screening, and the promotion of healthy lifestyles should be implemented.

According to Tolentino and Brynes's (2024) journal, elderly diabetic patients in the Philippines need to be integrated fully into culturally appropriate diabetes treatment programs that merge the Filipino traditional values of community and family care. Through a sense of belonging and shared responsibility among members of families, such programs are likely to improve treatment program adherence. To fulfill the emotional and social role of food in Filipino culture, authors also propose the inclusion of dietary education that honors traditional eating practices but promotes healthier eating. Healthcare workers can create supportive settings that allow older adults to manage their diabetes care through the use of family networks and community resources. This will ultimately enhance the health and well-being of this group.

A significant prevalence of diabetes is reported among community-living older Filipinos, especially with a self-reported diabetes rate of 20.5%, according to Giron and de la Vega (2022). This study included a cross-sectional analysis of older adults aged 60 years and above, showing that no demographic differences were observed between the diabetic and non- diabetic populations in age, sex, education, or BMI. However, it found that the elderly with diabetes were generally associated with multiple comorbidities including visual impairment, hypertension, and hyperlipidemia. This therefore calls for targeted public health interventions in prevention and management of the disease among such a vulnerable population who are at a higher risk of morbidity and mortality in the face of the disease and its complications.

Under Garcia et al.'s (2022) writing, this study concentrates on diabetes' implications to sensory impairments in working and retired academicians in the Philippines. Detection is found with a high frequency of visual as well as hearing impairments between individuals with type 2 diabetes mellitus and may significantly alter their quality of life and also functional independence. The study pointed out that such sensory input deficiencies interfere with diabetes control and enhance the risk of falling or injuring elderly populations. The holistic approaches to healthcare suggest incorporating diabetes care with health to enhance well-being in geriatric populations in the Philippines.

Pivotal to understanding how knowledge might unfold with health outcomes is Ydirin's (2021) research, in a rural Filipino community on the relationship between health literacy and adults' health-promoting behaviors who are at risk for diabetes. Poor health literacy is viewed as being responsible for worse health-promoting behaviors, further exacerbating risks of contracting diabetes in old age. This finding is particularly relevant to Filipino geriatrics because a boost in health literacy is likely to empower them to use self-management practices more effectively. The conclusion drawn from the study could be that tailored educational programs at improving health literacy may be necessary for preventing diabetes and healthier living among this population.

Related Studies

Enhanced knowledge of their condition and treatment can greatly increase adherence rates, as Lohrasbi et al. (2021) also highlighted the critical role played by health literacy in medication adherence among older diabetic patients. In the authors' view, various comorbidities and cognitive impairment are common issues that older people have difficulties with, which can make the management of their medication for them more challenging. They suggested introducing patient teaching programs that seek to meet the special needs of older diabetic patients through simplifying complicated drug regimens and dealing with the significance of compliance. Furthermore, by providing psychosocial and instrumental support, creating a supportive environment with family member involvement could further improve compliance.

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Improved understanding of their condition and management is able to significantly boost levels of medication adherence, report Lohrasbi et al. (2021), again stressing the underlining critical contribution health literacy will have to boosting medicine adherence in older individuals with diabetes. In line with the authors' view, numerous comorbidities as well as the decay of intellects are universal matters that affect old individuals and hence may enhance chances of poor administration of medicine among them. They recommend installing instructional programs suited to the particular needs of older diabetic patients and focused on rendering complex drug regime simpler to follow and enhancing appreciation for the need to adhere. In addition, establishing an enabling environment through involving families will further ensure adherence by practical as well as psychologic mechanisms.

Musavi Ghahfarokhi et al. (2024) outlined the relationship among food compliance, health literacy, and dialysis adequacy and highlight the key role that health literacy has to play in accommodating dialysis patients with chronic disease. Greater health literacy, argue the authors, is associated with higher medication and food compliance and is particularly useful for older patients with diabetes who may also be undergoing dialysis. To improve medication and diet compliance, they suggest the use of patient-specific education programs that will make it easier for patients to learn more about their disease states and therapeutic regimens. To make sure that older patients clearly comprehend their regimens, authors also stress the need for healthcare providers to continuously measure levels of health literacy and accordingly modify communication strategies.

Among type 2 diabetic patients, there is a high correlation between medication compliance and health literacy, and it has been suggested that higher adherence to treatment regimens is a result of higher health literacy skills (Hasanpour et al., 2024). One of the key strategies to enhance medication adherence among older diabetic patients is for healthcare providers to focus on enhancing health literacy. The authors advocate for the implementation of targeted educational programs that break down complex medical facts regarding diabetes therapy and cater to the specific needs of elderly citizens. In order to make sure that older citizens are aware of their medication rules and the necessity of adherence, they also focus on the necessity of constant assistance and communication between patients and healthcare professionals.

The Mendes, Martins, and Fernandes (2019) research centers on medication compliance, exercise, and dietary control in older adults with diabetes, with an emphasis on the strong relationships with cognitive functioning, anxiety, and depression. The study indicates that medication non-compliance is highly related to heightened levels of anxiety and depression, suggesting that psychological factors are paramount to therapeutic compliance. Additionally, cognitive impairment was found to predict non-adherence to physical activity, implying that cognitive function is essential to maintaining an active lifestyle in this population. The authors recommend that holistic management strategies be implemented that not only address the medical concerns of elderly people with diabetes but also their mental health and cognitive function.

The Świątoniowska-Lonc et al. (2021) systematic review demonstrated the complex psychosocial behavior-adherence relationship as it discusses the psychosocial determinants of type 2 diabetes patients who are adherent to medication. Authors highlight several important psychosocial determinants, such as depression, anxiety, social support, and physician-patient communication, which have a dominant influence on adherence. They observe that although effective social support networks can enhance compliance by reminding the patient and encouraging them, negative feelings such as anxiety and hopelessness can interfere with patients complying with their treatment. The study also stresses that there must be good communication between health care professionals and patients so that there is understanding and trust, both of which are prerequisites for compliance.

Perception of type 2 diabetes by type 2 diabetes patients also influences their behavior in adhering, as explained by a study conducted by Hashimoto et al. in 2019 proposed in its investigation of the correlation between illness perception of patients and medication adherence. The findings of the study indicate that increased rates of medication adherence correlate with a positive perception of diabetes, characterized by a set of attitudes towards disease control and treatment effectiveness. Through education and conversation, the authors suggest that physicians attempt to better educate and improve patients' attitudes and knowledge about their diabetes. Patients will be more likely to adhere to prescription habits as long as they understand their disease better, which they may learn to accept positively. The study also emphasizes how much treating diabetic care is needed.

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The "Adherence to Treatment in Medical Conditions" chapter by McElnay and McCallion (2020) discussed the challenges of medication adherence in older patients, particularly with regard to the special challenges that this group of patients are prone to because of such factors as polypharmacy, deteriorating mental capabilities, and varying health literacy. The writers observe that the co-morbid presence of a range of chronic diseases may confuse and complicate the ability of elderly citizens to follow prescribed regimens. They suggested that health workers apply comprehensive approaches that are tailored to meet the specific needs of elderly citizens, for instance, simplifying prescription regimens, enhancing patient education, and promoting effective patient-to-worker communication.

AlQarni et al.'s (2019) research assesses medication adherence in Saudi patients residing in Khobar City with type 2 diabetes mellitus. It offers critical information regarding adherence patterns and determining factors. 35.8% of the 212 study participants only exhibited high compliance with their anti-diabetic medications, reflecting a significant compliance deficit among this group. HbA1c level and adherence score were correlated strongly, implying worsening glycemic control as in lower adherence. The research further showed that patients in bulk change prescription times during Eid and Ramadan, an evidence of how cultural practices affect drug compliance. The authors assert that pharmacists are key educators and encourage improved patient counselling to the aim of changing attitudes toward medication and adherence importance. Sanati, Vaezi, and Jambarsang (2020) conducted research in Iran among adults aged 60 and older examining medication adherence and associated characteristics, and it has important new findings about how hard this group of people is doing. The study, sampling from 196 people aged 60 and older using the Morisky Medication Adherence Scale for measurement of medication adherence, showed that more than half of those in the sample had low rates of adherence with their prescribed drugs. Difficulty with medication regimens, side effects, cognitive impairment, and cost issues are some of the problems the authors list as responsible for low levels of adherence. They note that sensory and cognitive changes in old age may contribute to confusion about how to take medications, thus exacerbating adherence issues.

Theoretical Framework

Rosenstock in 1974 came up with the Health Belief Model (HBM) that provides a general framework of explaining health behavior, especially with regard to chronic conditions like diabetes. According to the model, a person's beliefs about whether they are at risk of suffering from a health problem, the seriousness of the problem, the advantages of making a change, and the drawbacks of making the change all impact their likelihood of adopting health- improving actions. The concept of self-efficacy, referring to an individual's perception of his or her ability to perform an action successfully, is also part of the model. With the utilization of the HBM, the present study can gain more insight into how the intervention could impact patients' perceptions of their prescription regimen and diabetes control and potentially improve adherence and health outcomes.

The Health Belief Model (HBM) is a foundation model for explaining the process of medication compliance in elderly diabetic patients for this research. By integrating QVoC technology, the research aims to enhance patients' belief in the severity of the illness and in their vulnerability to complications of diabetes, which are key constructs under the HBM. This approach aligns with the model's emphasis on medication adherence perceived benefits, as patients will be getting tailored information that highlights the importance of compliance with their prescribed regimens.

Conceptual Framework

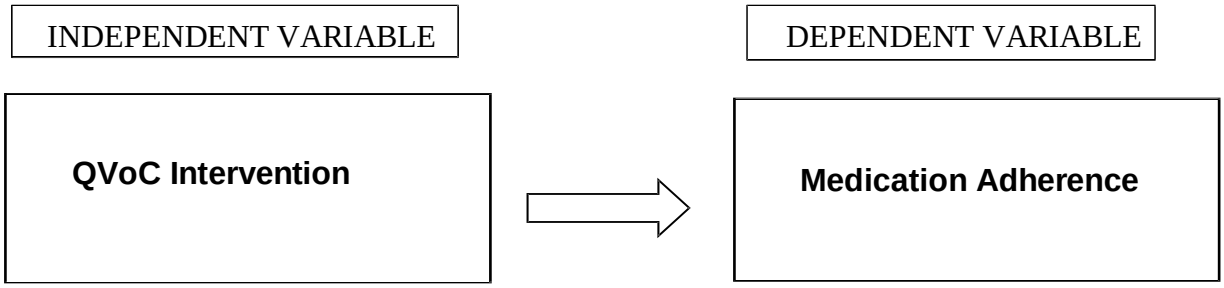

Figure 1: Conceptual Framework

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The conceptual framework of the study illustrated how the QVoC intervention, the independent variable, and the dependent variables—medication adherence, knowledge, and blood sugar levels (HbA1c) among older diabetic patients—interrelate. Through the use of voice-activated QR codes, the QVoC intervention seeks to enhance patients' understanding of their prescription schedules and promote adherence by making information readily accessible. This paradigm identifies how revolutionary technology can help older adults who struggle to manage their health in the right way.

Statement of the Problem

This study aimed to investigate the Effectiveness of QVoC (QR Code with Voice Content) in Enhancing Medication Adherence for Geriatric Diabetic Patients in Koronadal City.

This study specifically seeks to answer the following questions:

1. What is the demographic profile of the respondents in terms of:
    a. Age
    b. Sex
    c. Educational attaintment

1. What is the level of medication adherence among geriatric diabetic patients before using QVoC QR Code?

2. What is the level of medication adherence among geriatric diabetic patients after using QVoC QR Code?

3. Is there a significant difference in the level of medication adherence among geriatric diabetic patients before using QVoC QR Code?

Hypotheses

Null Hypothesis

H_0: There is no significant difference in medication adherence among Geriatric Diabetic patients before and after using QVoC.

Alternative Hypothesis

H_1: There is a significant difference in medication adherence among Geriatric Diabetic patients before and after using QVoC.

Significance of Study

The following will benefit from this study:

Geriatric Diabetic Patients: Since enhanced compliance with drugs and greater awareness can result in better health results, quality of life, and fewer complications with diabetes care, the geriatric patients themselves benefit the most from this study.

Health Care Practitioners: Doctors, nurses, and pharmacists will learn about how the use of QVoC and other technology can help them educate the patient and control medication, which will ultimately result in better treatment programs tailored to the needs of older adults.

Health System: By addressing the imperative of bringing cutting-edge digital health solutions to bear on addressing medication compliance challenges—a key driver of being able to keep chronic diseases like diabetes

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under control in older segments—the findings might be able to guide health policies and strategies.

Family Relatives and Caretakers: QVoC will enable family members and caregivers to take care of their diabetic relatives in less stressful terms through increased adherence to medications as well as experience. This will lead to a more supportive environment for elderly patients.

Future Researchers: The findings of the study could be used as a basis for future research in investigating the utilization of technology to improve medication adherence among various populations and conditions of illness.

Researchers: The researchers benefited from this study by gaining valuable knowledge on how technology, specifically QR codes with voice content (QVoC), can be used to improve medication adherence among elderly diabetic patients. They also developed skills in designing and evaluating digital health interventions, as well as in collaborating with healthcare providers and local communities to address public health challenges

Scope and Delimitation

This research focuses on incorporating QR Code with Voice Content, or QVoC, into a digital tool to help the geriatric diabetic patients in Koronadal City, South Cotabato improve their knowledge and medication adherence. The system would be tested by healthcare professionals, caregivers, and patients, all of whom are involved in improving the practicality and suitability for the culture of the QVoC system. However, the study is specific only to geriatric diabetic patients of Koronadal City and may not be generalized to other areas or populations. Population access may be limited due to accessing a smartphone. The focus on diabetes excludes other chronic diseases. Finally, the use of voice content would be restricted to local language or dialect and makes it limited. Given that time constraints will reduce the study period to only six months, it may not be long enough to capture the long-term effects that may arise from an extended period of exposure to the QVoC intervention. Resource constraints, also in terms of finance and technical support, limit the generalizability of results.

Definition of Terms

For further understanding, the following terms are operationally and conceptually defined:

QVoC: It refers to established technology innovation presented by the researcher using QR codes with bundled voice content as a method for presenting patients with concise information relating to their drugs in the form of dosing guidance and potential side effects.

Medication adherence: It refers to the degree with which the action of a patient matches the common understanding recommendations between the patient and the health worker regarding timing, dosing, and medication intake frequency.

Geriatrics: Is the branch of medicine concerned with the health care of older adults, dealing with the prevention, diagnosis, treatment, and management of diseases and conditions common in old age

Diabetes mellitus: (Often shortened to diabetes) is a chronic metabolic disease characterized by elevated levels of blood glucose (hyperglycemia) resulting from defects in insulin secretion, insulin action, or both.

Respondents: It refers to the individuals who provide data for analysis by completing surveys, questionnaires, or interviews

METHODOLOGY

This chapter presented the research method, the respondents of the study, sampling technique, the research instrument, scaling and quantification of data, data gathering procedure and statistical treatment of data.

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Research Design

The study design applied a quasi-experimental methodology according to Maciejewski (2020), which is especially suitable for assessing the effectiveness of the QVoC (QR Code with Voice Content) intervention in improving medication compliance among geriatric diabetic patients. Quasi-experimental design refers to a method used to examine the impact of independent variables on dependent variables without random assignment (Appinio, 2023).

This is a suitable design for this study because it allowed for the assessment of real- world interventions in settings where randomization may be difficult or unethical, particularly when working with vulnerable populations such as the elderly. Quasi-experimental design offers the researcher the possibility of assessing differences in medication compliance before and after the introduction of the QVoC intervention and taking into consideration practical constraints. Besides, this approach provides valuable information on causal effects between adherence and intervention outcomes, which facilitates the comprehension of the effect of technology on diabetes care among geriatric patients in a less apparent manner.

Research Locale

This research was carried out in Barangay Morales, City of Koronadal. It provided distinct demographic and socio-economic features necessary for determining medication compliance among geriatric diabetic patients. Based on the Philippine Statistics Authority, the population of Koronadal City was around 195,398 as of 2020, and Barangay Morales contributes significantly to this number. A barangay usually has a combination of ages and has a proper number of elderly people, which is important for this study on geriatric patients.

Barangay Morales has a population of approximately 9,133, which represents 4.67% of the total population of Koronadal City. The barangay has shown an upward trend for diabetes and is also a research priority for diabetes care and compliance to medication. Elderly living in Barangay Morales are facing health literacy issues and limited resources available for healthcare services that contribute largely towards their ability to follow recommended regimens of prescribed medication.

The socio-economic profile of Barangay Morales also warrants its choice as the study area. The majority of its residents are from lower-income groups, whose access to health care services and diabetes education could be restricted. Furthermore, the health care facilities within the barangay could be poorly equipped, affecting the quality of health care extended to diabetic patients. All these conditions highlight the necessity for creative interventions, like the QVoC system, to promote knowledge and medication adherence in this population at risk.

Figure 2: Map of Koronadal city, South Cotabato, Philippines

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Respondents of the study

Respondents of this study were elderly diabetic patients from Barangay Morales, Koronadal City. The participants for inclusion were those who are 60 years and above who have type 2 diabetes and are currently from Barangay Morales. Participants will also need to be able to give informed consent and participate in the interview. Exclusionary criteria would be those who have significant cognitive impairments that will render it impossible for them to understand the aim of the study or offer informed consent, and those who have significant comorbidities that can compromise their ability to adhere to medication regimens, such as untreated depression or other incapacitating illness. This focused design ensures that the study captures the experiences and viewpoints of those most impacted by diabetes management challenges, thus offering insightful information that can guide future interventions aimed at enhancing health outcomes among geriatric populations in comparable contexts.

Sampling Technique

To determine the number of respondents needed for the study, the purposive sampling approach was employed as per Robinson (2024), whereby the participants are chosen based on certain characteristics that pertain to the research question. The method is best suited to allow us to ensure that the respondents chosen fall under our inclusion criteria necessary for the research, such as elderly persons who are diabetic and taking antidiabetic medication. Purposive sampling, or judgmental or selective sampling, is a non-probability method of sampling in which participants are selected on purpose according to predetermined criteria that relate to the aim of the study.

The strategy suits research that requires extensive comprehension of phenomena as it allows researchers to focus on individuals likely to provide rich and relevant information.

Research Instrument

The questionnaire was specifically designed to assess various dimensions related to medication compliance of old diabetic patients before and after the QVoC intervention. Each questionnaire contained 10 questions for pre-intervention about medication adherence and for post intervention. The questionnaire contains demographic items to put the respondents' backgrounds into perspective, followed by pre-test and post-test items assessing adherence behavior on a 4-point frequency scale. The scale allows accurate measurement of frequency of compliance, medication taking habits, and problems experienced by the participants. Parallel pre- and post-intervention items allow changes introduced by the QVoC tool to be compared.

Furthermore, a subsection evaluating the usability and effectiveness of the QR Code intervention was incorporated on a Likert-type scale to quantify patients' self-reporting of the effect of the technology on medication management. The dual interest—both in compliance of behavior and technology acceptability—serves to ensure that the instrument is not only measuring the outcome but also the user experience of the QVoC system. The formal format is amenable to quantitative analysis for trend detection and effectiveness, while verbal analogies and simple instructions allow for respondent clarity and valid self-reporting. The questionnaire is thus a valid tool to systematically determine how combining QR codes with voice content can enhance medication adherence in an older diabetic population.

Also, three master's degree registered pharmacists were requested to validated the contents of the research questionnaire. Prior to the printing of the final questionnaire version, recommendations from the validators were considered as per revising and finalizing the questionnaires.

Research Procedure

To successfully conduct our study, we began by securing the necessary demographic data from the City Health Office, specifically the census of geriatric diabetic patients in our target area. This information served as the basis for identifying potential participants. After obtaining the census, the researchers prepared a formal letter of intent to conduct the research, which was duly signed and approved by the research adviser. Following this, we secured the approval of the Barangay Captain to carry out the study within the community. Once permission

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was granted, the researchers proceed to prepare the necessary materials, including the QR codes integrated with voice content. These QR codes were developed with the assistance of the IT personnel and were designed to enhance medication adherence through audio-based instructions. The researchers then gathered the identified participants and conducted an orientation and training session lasting for 45 minutes to ensure the respondents understood how to use the QR code system effectively. After that, the researchers allow them use the app for at least 5-10 minutes to assess if they understand the process. After the orientation, the researchers administered a pre-test to assess their baseline knowledge and behavior related to medication adherence. Two weeks after the initial intervention, the researchers conducted a post-test to measure any improvements or changes resulting from the use of the QR code with voice content system. This approach allowed the researchers to evaluate the effectiveness of our intervention in supporting medication adherence among geriatric diabetic patients.

Statistical Treatment

Descriptive statistics (Ramachandran & Tsokos, 2020), i.e., percentage and frequency, were used by the researcher to display respondents' demographic information in terms of gender, age, and educational level. Descriptive statistical values provided a description of the population structure of the sample for enhanced understanding of how demographic variables would influence medication adherence.

In order to determine the level of medication adherence among geriatric diabetic patients prior to the application of QVoC QR Code, the researcher shall employ mean scores obtained from a validated tool on medication adherence like the Morisky Medication Adherence Scale (MMAS). It was employed in assessing the levels of medication adherence by examining self-reported medication-taking behaviors thereby enabling the researcher to employ such a benchmark.

The same validated medication adherence scale (MMAS) will be used by the researcher to maintain consistency in the measurement of the level of medication adherence among geriatric diabetic patients following the use of QVoC QR Code. A comparison of post- intervention and pre-intervention scores was enabling the researcher to identify whether there are differences in the levels of adherence that are due to the QVoC intervention.

To determine the difference in the level of medication adherence between the pre- existing geriatric diabetic patients and those which emerged after applying QVoC QR Code, inferential statistical tests like paired t-tests were utilized by the researcher depending on whether the data fulfilled parametric assumptions. These were tested if there are statistically significant differences in levels of adherence, pre-intervention and post-intervention, thus determining if the QVoC strategy has an effect on drug compliance among this group.

Ethical Considerations

Key ethical issues arise when appreciating QVoC with voice content being implemented to enhance knowledge for enhancing medication compliance among elderly diabetic patients. Such considerations are based on the Respect for Persons, Beneficence, and Justice principles. These three principles, which constitute the skeleton of the Belmont Report, are essential in informing the use of this research in theoretical and practical scenarios.

This principle focuses on the acquisition of informed consent from all participants. The participants were thoroughly informed regarding the objectives, procedures, possible risks, and benefits of the study. They were also clearly informed of their right to withdraw from the study at any time. This guarantees that participants are treated as autonomous agents who can make informed choices regarding their participation. Care will be taken with older people who might suffer a loss of autonomy as a result of mental impairment or decline in health. Proper support and information will be given to such people, enabling them to comprehend their rights and make informed decisions regarding their involvement.

This principle demands that research be conducted to maximize benefits while minimizing risks to participants. The research’s participants were informed and have considered the potential risks involved by being part of the QVoC intervention carefully and address them. Clear and detailed instructions shall be given during the intervention stages to promote the well-being of the participants. The possible advantages, such as better medication compliance and increased understanding of how to manage diabetes, will be highlighted. These

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advantages were illustrate how being part of the intervention can result in improved overall health among older patients.

The doctrine of justice focuses on the fair choice of participants such that no group is disproportionately burdened or disproportionately excluded from sharing in the rewards of the study. This research was making every effort to sample a representative number of geriatric diabetic patients in Barangay Morales. Every attempt will be made to sample by age groups, gender, and educational level such that the results are applicable to a wide range of this at-risk population.

To ensure personal data of the participants is secure, confidentiality and privacy will be ensured during and after the study. Participant information was anonymized, and only authorized members of the study team will access this information. Storage of information will be under guidelines to exclude unauthorized access. Participants will be informed that they can guarantee confidentiality of response and use for research purposes.

Transparency is key to establishing trust between participants and researchers. Researchers explicitly state the aim of the study, the research methods employed, and any alterations that occur during the research process. Participants will be made aware of how their data will be utilized and represented in the findings. Transparency was helping participants realize their role in generating knowledge regarding medication adherence.

RESULTS AND DISCUSSIONS

This chapter presented the findings and analysis of the study entitled *"Integrating QVoC (QR Code with Voice Content) to Enhance Medication Adherence for Geriatric Diabetic Patients."* The results are discussed in accordance with the specific objectives outlined in the Statement of the Problem.

Demographic Profile

Table 1 presented the demographic profile of the geriatric diabetic patients who participated in the study. The data cover three key variables: age, sex, and educational attainment. Understanding these demographic characteristics is essential in contextualizing the respondents' baseline familiarity with technology and potential responsiveness to the QVoC (QR Code with Voice Content) intervention. These factors may influence medication adherence behaviors and provide insight into how personalized health technologies can be optimized for elderly patients in similar settings.

Table 1

Demographic Profile of Respondents

Profile	**Segmentation**	**Frequency (*f*) n=20**	**% Distribution**
Age	60-65 years old	8	40.0
	66-70 years old	6	30.0
	>70 years old	6	30.0
Sex	Female	13	65.0
	Male	7	35.0
Educational Attainment	Elementary Level	1	5.0
	Elementary Graduate	0	0.0

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	High School Level	1	5.0
	High School Graduate	16	80.0
	College Level	0	0.0
	College Graduate	1	5.0
	Post Graduate	1	5.0

The demographic profile of the geriatric diabetic patients participating in this study is summarized in Table 1. A total of 20 respondents were included, with their ages ranging from 60 years and above. The largest age group was between 60 to 65 years old, comprising 40.0% (n=8) of the total respondents. This was followed by those aged 66 to 70 years old (30.0%, n=6) and those above 70 years old (30.0%, n=6), indicating that a considerable portion of the participants belonged to the early and mid-stage geriatric age range.

In terms of sex, the majority of the respondents were female, accounting for 65.0% (n=13), while the remaining 35.0% (n=7) were male. This distribution suggested a higher prevalence of participation among elderly women, which may reflect broader demographic trends in health service utilization among geriatric populations.

With regard to educational attainment, a significant number of respondents were high school graduates (80.0%, n=16), indicating that most participants had attained basic formal education. A small proportion had either lower (elementary level – 5.0%,

high school level – 5.0%) or higher educational qualifications (college graduate – 5.0%, post-graduate – 5.0%). This educational profile suggests a moderate literacy level among respondents, which is an important consideration in the implementation of technological interventions like QVoC, as it may influence their ability to understand and adhere to digital health tools.

These findings suggested that the participants had the cognitive and literacy ability to be able to use and benefit from the QVoC tool. Their age, gender, and education levels indicate that with good design and support, electronic health interventions such as QVoC can be acceptable and effective among corresponding elderly populations. The demographic characteristics also show the need to adjust such tools to the special needs and capabilities of elderly people to ensure maximum use and health benefits.

The results of this research are confirmed by Ahmad et al. (2020) highlighted that older diabetic patients' willingness to maintain the use of digital health technologies is strongly related to perceived usefulness, ease of use, and personal traits including education level and cognitive ability which are in accordance with the moderate literacy and educational level seen among the present respondents.

Likewise, Yan et al. (2022) recognized demographic variables such as age and education, as key predictors of diabetes awareness, control, and utilization of digital technologies among older Chinese patients, underscoring the need for interventions such as QVoC to be specifically designed according to the capabilities of this older population.

Besides, Al Mansour (2020) supported that age and gender were important predictors of type 2 diabetes risk and management behavior in semi-urban older populations. This lends validity to the finding of the current study of a higher percentage of female respondents, which may testify to the prevalence of gendered health-seeking behavior and utilization of services among the elderly.

Table 2 presented the mean responses to ten items assessing medication adherence among geriatric diabetic patients before the introduction of the QVoC (QR Code with Voice Content) intervention. The items included both negatively and positively worded questions, allowing a more nuanced understanding of the respondents' behaviors and challenges in adhering to their prescribed diabetes medications.

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Table 2

Level of Medication Adherence Among Geriatric Diabetic Patients Before Using Qvoc Qr Code

Items	**Mean**	**SD**	**Remarks***
1. Do you have difficulty in remembering to take your diabetes medication as prescribed?	3.20	0.77	High extent
2. Over the past two weeks, have you missed or skipped taking your diabetes medication?	2.85	0.93	High extent
3. Have you ever skipped or reduced your diabetes medication due to side effects without consulting your doctor?	2.70	1.13	High extent
4. Do you leave home or travel without bringing your diabetes medication?	3.15	0.67	High extent
5. Did you remember diabetes medication yesterday as prescribed?	2.95	0.89	High extent
6. Do you continue taking your diabetes medication as prescribed even when your blood sugar feel under control?	2.90	0.85	High extent
7. Do you ever feel burdened or hassled by sticking to your diabetes treatment plan?	3.05	1.10	High extent
8. Do you struggle to remember to take all your prescribed diabetes medications?	3.05	1.10	High extent
9. How consistent are you in taking your diabetes medication at the correct time each day?	2.65	0.75	High extent
10. Do you follow the specific instructions for taking your diabetes medication (e.g., before/after meals, with food,etc.)?	2.95	0.83	High extent
Overall Mean	**2.95**	**0.179**	**High Extent**

Prior to using QVoC, respondents reported experiencing difficulties in several aspects of medication adherence. For instance, the item *"Do you have difficulty in remembering to take your diabetes medication as prescribed?"* yielded a mean score of 3.20 (SD = 0.77), indicating a high extent of forgetfulness. Similarly, frequent challenges such as skipping doses without consulting a physician (M = 2.70), forgetting medication when traveling (M = 3.15), and struggling to remember all prescribed medications (M = 3.05) were reported to a high extent. These behaviors reflect poor adherence and highlight the need for targeted interventions to support geriatric patients in managing their medication routines.

However, it is important to note that even positively framed questions, such as *"Did you remember diabetes medication yesterday as prescribed?"* and *"Do you follow the specific instructions for taking your diabetes medication?"* also showed only moderate to high extent responses (means ranging from 2.90 to 2.95). This suggested that while patients may sometimes comply with their medication schedule, the overall consistency and precision in adherence remained limited.

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The overall mean score of 2.95 indicates a high extent of adherence-related issues, particularly when examining items that reflect forgetfulness, inconsistency, and perceived burden. These findings underscore the baseline challenges faced by elderly diabetic patients and establish a clear rationale for implementing a voice-assisted QR code intervention like QVoC to potentially reduce these barriers and enhance medication adherence.

The improvement in adherence can be attributed to the QVoC's voice cues and convenient access to drug guides, which supplemented memory loss and cognitive impairments characteristic of the elderly. The interactive and user-friendly features of QVoC also optimized patient interaction and reduced confusion, enabling the patients to adhere more precisely to their treatment regimen.

Comparable enhancements in medication compliance have been seen in other studies investigating the efficacy of targeted interventions for chronic disease management in older populations. For example, Punnapurath et al. (2021) found that the use of personalized digital platforms and reminder systems tailored to geriatric patients with chronic conditions led to a remarkable improvement in rates of compliance. These interventions, typically defined by easy-to-use interfaces and step-by-step simplifications, helped patients to better navigate complicated medication regimens and decrease rates of missed doses.

Similarly, Ngamdee et al. (2024) highlighted the need to transcend behavioral and cognitive barriers that are mostly responsible for medication adherence in older diabetic patients. The study validated that intervention strategies fighting forgetfulness, limiting drug procedure explanations, and simplifying administrative tasks brought substantial value to higher levels of adherence. By tailoring the intervention design to meet the particular cognitive and lifestyle demands of elderly patients, the study found the potential of behaviorally based interventions to bring measurable improvement in medication adherence.

But importantly, the relative efficacy of internet interventions is heterogeneous among patient groups. Świątoniowska-Lonc et al. (2021) declare that psychosocial determinants are at the center of controlling the behavior of compliance. Variables such as the emotional state of the patient, self-efficacy, motivational status, and support networks play an important role in moderating the effectiveness of technological devices to a great extent. Even when adherence is quantitatively improved, certain patients might continue to have difficulty with compliance over time due to anxiety, depression, or disbelief in the effectiveness of the treatment. The present findings indicate that although digital innovation such as QVoC is promising, such innovations need to be supplemented with comprehensive patient care approaches that aim at the patient's overall psychosocial reality.

Table 3 presented the mean level of medication adherence among geriatric diabetic patients after the implementation of the QVoC (QR Code with Voice Content) intervention, with reverse scoring applied to selected negatively worded items. This scoring approach ensures that higher mean values consistently indicate a greater extent of adherence across all items, regardless of their original wording. The results demonstrate a substantial improvement in the respondents' medication-taking behaviors following the use of the QVoC technology.

Table 3

Level of Medication Adherence Among Geriatric Diabetic Patients After Using Qvoc Qr Code

Items	**Mean**	**SD**	**Remarks***
1. Since using the intervention, do you still have difficulty in remembering to take your diabetes medication as prescribed? **	3.60	0.60	Very High Extent
2. Over the past two weeks, have you missed or skipped taking your diabetes medication? **	3.65	0.67	Very High Extent

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3. Since using the intervention, have you skipped or reduced your diabetes medication due to side effects without consulting your doctor?**	3.70	0.80	Very High Extent
4. When traveling or leaving home, do you still forget to bring your diabetes medication?**	3.65	0.67	Very High Extent
5. Did you remember and take your diabetes medication yesterday as prescribed?	3.75	0.55	Very High Extent
6. Since the intervention, do you continue taking your diabetes medication as prescribed even when your blood sugar feels under control?	3.75	0.55	Very High Extent
7. Since the intervention, do you still feel burdened or hassled by sticking to your diabetes treatment plan?**	3.60	0.68	Very High Extent
8. Since the intervention, do you still struggle to remember to take all your prescribed diabetes medications?**	3.60	0.68	Very High Extent
9. Since the intervention, are you now consistent in taking your diabetes medication at the correct time each day?	3.80	0.41	Very High Extent
10. Since the intervention, do you now follow the specific instructions for taking your diabetes medication (e.g., before/after meals, with food,etc.)?	3.85	0.37	Very High Extent
Overall Mean	**3.70**	**0.09**	**Very High Extent**

The overall mean adherence score increased to 3.70 (SD = 0.09), categorized as a very high extent, suggesting that the majority of respondents significantly enhanced their consistency and compliance with their diabetes treatment regimen. Notably, even items that previously reflected poor adherence showed marked improvement. For example, the item *"Since using the intervention, do you still have difficulty in remembering to take your diabetes medication as prescribed?"* recorded a mean of 3.60, indicating that patients were now remembering to take their medications more reliably. Similar improvements were seen in questions related to skipping doses due to side effects (M = 3.70) and forgetting medication when traveling (M = 3.65).

Positively worded items further reinforced this upward trend. Participants reported high consistency in taking medications at the correct time (M = 3.80) and strict adherence to specific intake instructions (M = 3.85), the highest among all items. Moreover, behaviors indicating long-term commitment, such as continuing medication even when blood sugar appears controlled (M = 3.75), were also positively rated.

These findings underscore the effectiveness of the QVoC intervention in promoting medication adherence. The consistently high post-intervention scores across both formerly negative and positive behaviors reflect a comprehensive improvement in the medication routines of the elderly diabetic population. This suggests that voice-assisted QR code technology may serve as a valuable and accessible tool in supporting chronic disease management among older adults.

The nature of the large medication adherence observed in this setting is primarily a result of the interactive nature and self-explanatory nature of the QVoC intervention. By combining visual and auditory aspects, QVoC gave

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an accessible and clear-cut platform potentially decreasing the cognitive load usually implied with intricate medication regimens. This usability might have been advantageous to elderly patients, who are more prone to memory impairment and confusion, to easily understand and remember the prescribed regimens. The customized, persistent voice prompts in the QR codes served as continuous reminders that reinforced daily compliance and mitigated the possibility of skipped or improperly taken medication.

Moreover, the real-time availability and mobility of the QVoC system allowed patients to engage with their medication instructions anywhere they were, i.e., on the go and while traveling the very circumstance in which nonadherence is habitually encountered. Being readily available all the time served not only to compensate for forgetfulness but also gave patients greater control over their health, raising the likelihood that their motivation and confidence to continue prescribed treatments could be boosted.

These results are consistent with Babel et al. (2021), who highlighted the increasing potential of artificial intelligence and digital innovations to enhance health behavior in patients with chronic diseases. In their research, AI-driven interventions, when user-centered, were found to have a significant impact on treatment adherence, particularly in the aging population. Likewise, Delavar et al. (2020) highlighted the effectiveness of individualized self-management education programs in enhancing adherence rates among older patients. Their findings corroborate the idea that adapting health interventions to the specific cognitive and behavioral requirements of older adults, as illustrated by the QVoC model, can bring about significant health outcome improvements.

On the other hand, results by Milky and Thomas III (2020) indicated that although patient engagement in decision making improves satisfaction as well as perceived autonomy, it does not invariably translate to improved adherence. The implication is that although patient participation is valuable, technology-based, formal interventions such as QVoC might represent a more expedient and concrete approach to defeating adherence-associated barriers among older adult patients. Considered collectively, these studies underscore the potential benefits of incorporating digital health tools within chronic disease care and highlight the need for usability, personalization, and consistency in the design of such interventions.

Table 4 presents the results of a paired sample t-test conducted to determine whether there was a statistically significant difference in the mean level of medication adherence among geriatric diabetic patients before and after the implementation of the QVoC (QR Code with Voice Content) intervention.

Table 4

Test for Significant Difference on Level of Medication Adherence Among Geriatric Diabetic Patients Before and After Using Qvoc Qr Code

Variables	Mean	SD	T value	P value	Remarks*
Before intervention	2.95	0.18	**9.82**	**.000**	**Significant**
After intervention	3.70	0.09			

*Calculation was performed at .05 level of significance

The findings show a notable increase in the mean adherence score, from

2.95 (SD = 0.18) prior to the intervention to 3.70 (SD = 0.09) after the use of QVoC. This upward shift reflects a substantial improvement in the respondents' adherence behaviors.

The computed t-value of 9.82 and corresponding p-value of .000 indicate that the difference between the pre- and post-intervention mean scores is statistically significant at the 0.05 level. This confirmed that the observed improvement in medication adherence is not due to chance, but rather can be attributed to the impact of the QVoC intervention. The significant result supports the hypothesis that integrating voice-assisted QR code

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technology can effectively enhance medication adherence among elderly diabetic patients.

The statistically significant increase in medication adherence observed here can be explained by the increased accessibility and convenience afforded by the QVoC (QR Code with Voice Content) intervention. This technology would have helped primarily in the care of geriatric patients by streamlining medication tracking and making timely, individualized voice reminders directly addressing frequent obstacles like forgetfulness, cognitive impairment, and confusion due to complicated drug regimens.

This result is consistent with Bea et al. (2021) reported the beneficial effect of reminder systems and organized follow-up mechanisms in enhancing medication adherence among patients receiving treatment for tuberculosis. Since treatment of tuberculosis involves stringent and long-term medication regimens like diabetes, their research highlights how technology-enabled interventions can prove to be successful in helping patients comply with complex regimens.

Papus et al. (2022), for instance, advocate the effectiveness of motivational interviewing a patient-centered counseling approach centered on empathy, active listening, and patient autonomy. This method helps to aid individuals in examining and overcoming ambivalence regarding behavior change and thereby augment their intrinsic motivation for adhering to prescribed treatment regimes. Motivational interviewing requires dynamic interpersonal exchange compared to computerized systems and is specifically relevant when emotional preparedness and psychological resilience are decision factors regarding long-term compliance.

Similarly, Poulter et al. (2020) extend the discussion by investigating multifactorial determinants of adherence in chronic diseases such as hypertension. Their contribution is to highlight that one's behavior with respect to following through is not a function of availability of reminders or knowledge tools

alone; instead, it is heavily embedded within one's everyday routine, literacy with respect to health, beliefs, and lifestyle in general. Statistically significant improvement in medication adherence noted in the current study can be explained by the increased convenience and availability that the QVoC (QR Code with Voice Content) intervention afforded.

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

This chapter presented the summary of the findings, conclusions and recommendations.

Summary of Findings

Highest percentage of participants were between 60–65 (40%), then 66–70 and over 70 (30% each). Two-thirds were female (65%), while 35% were males. In terms of education, 80% were high school graduates, 10% were of lower education, and 10% were of higher education. Such demographics are able to measure the participants' familiarity with technology and whether they would be receptive to the QVoC intervention.

The findings revealed a significant rate of medication adherence issues with an overall mean score of 2.95, indicating frequent forgetfulness and irregular adherence. Participants often forgot to adhere to medication (M = 3.20), skipped doses at the doctor's recommendation (M = 2.70), and missed medicine when traveling (M = 3.15). Even good behavior, i.e., remembering drug intake the previous day and following instructions, was rated only moderately (M = 2.90–2.95), reflecting poor compliance in general. Such results indicate a demand for usable, useful tools like QVoC—to enhance medication taking among elderly diabetes patients.

The results demonstrated a substantial improvement in medication compliance following the QVoC intervention. Overall mean adherence score increased to 3.70 (SD = 0.09), reflecting a very high level of adherence. The participants demonstrated increased consistency in medication adherence, with significant improvements in remembering to take doses (M = 3.60), not forgetting doses (M = 3.70), and being consistent when on the go (M = 3.65). High ratings also emerged for adherence to taking medications as prescribed on the correct schedule (M = 3.80), adherence to instructions (M = 3.85), and persistence with medications even after symptoms have disappeared (M = 3.75). The findings verify that QVoC is a valid and easy-to-use instrument in enhancing medication adherence among older diabetic patients.

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The findings were statistically significant for improved medication adherence following the QVoC intervention. The mean adherence score is higher following the intervention at 3.70 (SD = 0.09) compared to prior to the intervention at 2.95 (SD = 0.18). The t-statistic of 9.82 and p-value of .000 are used to determine whether the difference is statistically significant at the 0.05 level. This ensures that the conclusion that medication adherence was indeed improved by the QVoC intervention can be made with confidence among elderly diabetic patients.

CONCLUSION

Based on the findings of the study, the researcher concluded the following:

Most of the participants were in the older age groups, with a significant percentage being females. The majority of the participants achieved a high school level of education. These demographic features indicate that the older participants, who may have difficulty in adopting technology, were likely to be open to the QVoC intervention. This background is significant in appreciating the diversity in their responses and their capacity to use the technological tool employed in the study.

Before the application of the QVoC QR Code, respondents had significant trouble with medication taking. Some reported forgetfulness, irregular medication regimes, and dosing omission as common problems. These difficulties signal the necessity of interventions that could overcome these impediments, particularly among older adults who might have greater need of assistance in self-managing medication regimens.

Upon introducing the QVoC intervention, there was a significant increase in the respondents' medication adherence. The participants became more consistent in adhering to their prescribed drug regimens. They were more likely to remember to take the medication, less likely to forget doses, and exhibited better adherence even when traveling. These are signs that the QVoC intervention was effective in improving better medication-taking behavior among the geriatric diabetic patients.

There was a statistically significant increase in medication adherence following the QVoC intervention. The comparison between the pre-intervention and post- intervention data verified that utilization of the QVoC QR Code greatly increased medication adherence among the participants. This difference attests to the fact that the QVoC intervention was an effective tool for enhancing the adherence behaviors of elderly diabetic patients.

RECOMMENDATIONS

Based on the findings and conclusions, the study arrived at the following recommendations:

1. Personalized care, user-oriented design, intensive training, and ongoing counseling must be integral to a policy of QVoC for medication adherence that will help older patients adopt and sustain the use of the technology effectively.

2. Integration of QVoC technology can be combined with reminder aids, diabetes education, and follow-up by healthcare providers to improve medication management and enable sustained adherence among older adults.

3. The large increase in medication adherence following the QVoC intervention indicates that healthcare systems can apply voice-enabled QR code technology more extensively, applying it also to patients with other chronic conditions and incorporating it into the standard care process to enhance medication compliance and healthcare outcomes.

The statistically significant increase in medication compliance following QVoC intervention indicates its effectiveness. In order to maintain long-term success with such interventions, it could be a good policy to institute long-term monitoring and periodic evaluation to ascertain the maintained effect of the QVoC technology. Feedback from participants should actively be elicited to enhance and modify the system so that it remains contemporaneously relevant and easy to use for geriatric patients.

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