"NURSING INTERVENTIONS TO IMPROVE MEDICATION ADHERENCE IN PATIENTS WITH DIABETES: A CRITICAL REVIEW OF THE LITERATURE"

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Abstract:
This critical review focuses on nursing interventions that enhance medication compliance in patients with diabetes, based on a systematic search of the literature. Medication compliance is central to diabetes management while patients find it difficult to follow prescribed regimes because of barriers. Nursing interventions include educational, behavioral, technological, and supportive measures specific to adherence promotion and health outcomes. The review also outlines some of the best practices like patient education programs, motivational interviewing, telehealth applications, and peer support groups. Other challenges include socioeconomic differences, the healthcare system constraints, and the barriers to practice related to the nurse. Future directions include the focus on large-scale, long-term research, comparative efficacy trials, and social determinants interventions. Thus, by promoting the integration of research findings and utilizing new technologies, nurses can contribute significantly to the improvement of diabetes care and patient outcomes.

Keywords: Diabetes, medication adherence, nursing interventions, patient education, behavioral strategies

1. Introduction
1.1 Background on Diabetes and Its Prevalence
Diabetes mellitus is a long-term illness that causes high blood sugar levels due to a lack of insulin production or insufficient use of the hormone in the body. It is a major global health concern, as 463 million adults have been diagnosed with diabetes across the world in 2019, and this figure is projected to increase to 700 million by 2045 (International Diabetes Federation, 2019). Diabetes is common, and this means that there is a need to have proper management of the condition to prevent complications like heart disease, kidney failure, blindness, and amputation of lower limbs (American Diabetes Association, 2020).

1.2 Importance of Medication Adherence in Diabetes Management
Taking the right medication at the right time is one of the most important things to do when one is diagnosed with diabetes. Compliance with the recommended dosages of the medications ensures that the blood sugar levels remain balanced to avoid or minimize complications and improve the general well-being of the patient (Asche, LaFleur, & Conner, 2011). However, its compliance level among diabetic patients is low; research shows that up to half of the patients fail to stick to the recommended dosages (Shrivastava, Shrivastava, & Ramasamy, 2013). Lack of compliance is linked to higher expenses, higher rates of hospitalization, and increased morbidity and mortality (Ho et al., 2009).

1.3 Role of Nursing Interventions in Improving Medication Adherence
Patient compliance with medication has been identified as a critical area where nursing interventions are vital in patients with diabetes. Since nurses are in direct contact with the patient, they have the knowledge that can enable them to counsel, encourage, and assist the patient to adhere to treatment. Some of the approaches that have been recognized to improve adherence include patient education, behavioral approaches, and the use of technology (Polonsky & Henry, 2016). It is essential to address both the psychological and the practical aspects of the problem that hinder adherence; in this way, nurses will be able to assist patients in developing proper medication-taking behaviors and incorporating them into their everyday lives.

1.4 Purpose and Scope of the Review
This paper reviews the literature to provide a critical analysis of published works on the topic of nursing interventions for enhancing medication compliance among diabetes patients. This review will compare different forms of interventions, evaluate the efficacy of the interventions, examine the implementations' limitations and obstacles, and offer recommendations for practitioners. Based on the results of the current study, this review provides suggestions for healthcare practitioners and recommendations for future research on improving diabetes management using the nursing process.

2. The Importance of Medication Adherence in Diabetes Management
2.1 Definition and Significance of Medication Adherence
Medication compliance means the degree to which patients are compliant with the instructions given by their physicians regarding medication. This comprises the frequency, dose, and duration of administration of prescribed drugs (Osterberg & Blaschke, 2005). In diabetes care, compliance is critical in achieving desirable levels of blood glucose and the slowing of the disease process. Compliance with antidiabetic medications can go a long way in lowering the risk of complications associated with diabetes, enhancing the quality of life of a diabetic patient, and even lowering healthcare costs (Polonsky & Henry, 2016).

2.2 Consequences of Poor Adherence in Diabetic Patients
The effects of medication non-compliance in diabetic patients are dire and have numerous impacts on the health of the patients. Non-adherence to the prescribed medications results in poor glycemic control and consequently puts the patient at a higher risk of developing both the acute and chronic

complications of diabetes. Some of the acute complications include hyperglycemia and hypoglycemia which are severe complications that call for immediate attention (American Diabetes Association, 2020). Complications arising from poor compliance include cardiovascular diseases, nephropathy, neuropathy, retinopathy, and a higher risk of lower limb amputation (Shrivastava, Shrivastava, & Ramasamy, 2013). Further, non-adherence is linked to frequent hospitalization, increased costs of healthcare, and increased mortality levels (Ho et al., 2009).

2.3 Factors Influencing Medication Adherence
Non-adherence to medication is common among diabetic patients, and various factors affect it, these include patient factors, medication characteristics, and health systems characteristics.

1. Patient-Related Factors
- Psychological Factors: Mood disorders such as depression, anxiety, and stress can also make it difficult for the patient to follow medication schedules (Gonzalez and Steeves, 2008).
- Health Literacy: A low health literacy level may lead to a poor understanding of medications and their usage by the patients (Williams et al., 2014)
- Lifestyle and Socioeconomic Status: Time constraints, limited resources, and low social support are some of the factors that can prevent patients from adhering to their medication regimens (Shrivastava et al., 2013).

2. Medication-Related Factors
- Complexity of Regimen: Taking multiple medications that have different schedules can create confusion and non-adherence (Ingersoll & Cohen, 2008).
- Side Effects: Side effects of drugs can compel patients to discontinue their prescribed medication courses (Peyrot et al., 2012).

3. Healthcare System-Related Factors
- Healthcare Provider Communication: There is a need for proper communication between the healthcare provider and the patient to enhance adherence (Kelley et al., 2014).
- Access to Care: Poor health literacy and lack of health insurance may lead to restricted access to care and a lack of follow-ups and medication refills that may hinder adherence (Sokol et al., 2005).

These factors, therefore, need to be targeted through nursing interventions that enhance medication compliance and, in the process, the well-being of patients with diabetes.

3. Types of Nursing Interventions
3.1. Educational Interventions
- Patient Education Programs: Diabetes patient education programs aim at offering the patients essential information on the disease, the need to take the prescribed drugs, and ways of managing the disease. These programs may comprise teaching sessions, printed materials, and group discussions. Education is a critical component of patient care because it can help patients become more engaged in their care, which will help to increase adherence (Chrvala, Sherr, & Lipman, 2016).
- Health Literacy Enhancement: Health literacy enhancement is therefore directed towards improving the patient's ability to find, understand, and use health information. Simplified language, use of pictures, and teaching back are some of the strategies that the nurses can use to make sure that the patients understand the medication schedule and the implications of non-compliance. Health literacy is defined as the ability of people to obtain, understand, and use health information in ways that are appropriate for improving their health (Berkman et al., 2011).
- Counseling Sessions: Therapy sessions are individualized and involve the identification of the patient's issues and challenges regarding medication compliance. These sessions may encompass such topics as the psychological aspects of diabetes care, stress management, and ways of dealing with the challenges of chronic disease. Proactive counseling can largely improve adherence because it strengthens the patient-nurse relationship (Heisler et al., 2010).

3.2 Behavioral Interventions

- Motivational Interviewing: Motivational interviewing is a type of counseling technique that is used for patients to identify and overcome the patient's mixed feelings about taking their medication. Thus, by identifying and mobilizing the reasons for change, as well as promoting patients' self-determination, nurses can facilitate behavior change. Rubak et al., (2005) have revealed that this approach enhances compliance and glycemic regulation in diabetic patients.

- Cognitive-Behavioral Strategies: Cognitive-behavioral strategies are aimed at enabling the patient to recognize and change the negative thoughts and behaviors that prevent adherence. The psychological barriers can also be dealt with by using problem-solving skills, stress management, and coping skills training. These strategies are useful in enhancing long-term compliance and diabetes outcomes (Nicolucci et al., 2012).

- Goal setting and Action Planning: Thus, the setting of specific, achievable goals and the development of action plans can encourage patients to follow the prescribed medication regimen. Patient and nurse partnership can involve the identification of specific health objectives, formulation of strategies, and evaluation of the effectiveness of the implemented strategies. This creates patients' ownership of their treatment and increases their responsibility (DeWalt et al., 2009).

3.3 Technological Interventions

- Telehealth and Telemedicine: Telehealth and telemedicine are the processes of delivering healthcare services using telecommunications technology. This is because, through virtual consultations, the nurses can observe the patient's compliance levels and also intervene appropriately and support the patients constantly. Telehealth has also been proven to enhance medication compliance and health status in diabetic patients (Piette et al., 2000).

- Mobile Apps and Digital Reminders: Mobile applications and digital alarms are some of the modern approaches that help patients adhere to the schedule of taking medications. These technologies can include messages for medication times, reminders on the intake of medication, and educational material. Research also shows that there is an improvement in the level of compliance with medication regimens among diabetic patients when digital reminders are used (Lee et al., 2016).

- Electronic Health Records (EHR) Integration: The economic and social costs of obesity are a major concern for society and governments across the world. Coordination of medication management and Electronic Health Records (EHR) is possible hence improving care delivery. EHRs help the nurses in monitoring the patient's medication profile, detect the non-compliance, and take appropriate action. This integration helps to deliver individualized care and improve compliance through improved information management (Fischer et al., 2010).

3.4 Supportive Interventions

- Peer Support Groups: Diabetes self-management support groups enable patients to discuss issues regarding diabetes, successes, failures, and coping mechanisms. These groups provide encouragement, ideas, and inspiration, all of which can greatly improve the chances of taking medications as prescribed. Lorig et al., (2001) have highlighted that peer support enhances self-efficacy and facilitates compliance in diabetic patients.

- Family and Caregiver Involvement: Engaging the family members and caregivers in the management of diabetes can enhance compliance since the patient will have other people to remind him or her what to do. Families can help patients with the administration of medications, provide encouragement, and ensure that the patients stick to their prescribed regimes. The involvement of the family is also found to have a positive correlation with the level of compliance as well as the general health status of the patient (Rosland, et al., 2008).

- Community Health Programs: Diabetes community health programs provide care for diabetic patients in their communities. Such programs may be in the form of educational workshops, health

fairs, and community outreach programs. Thus, it is possible to state that community programs that target social determinants of health can improve medication compliance and diabetes management (Tang et al., 2005).

3.5 Pharmacological Interventions

- Simplification of Medication Regimens: Medication regimens can be simplified by reducing the complexity of the treatment plans like reducing the number of times the patient has to take the medications in a day or merging the medications. The complex regimens are difficult to follow for the patients while the simplified ones can enhance compliance greatly (Claxton et al., 2001).
- Medication Management and Reconciliation: Medication management and medication reconciliation entail assessing and coordinating patients' medications to identify the right dosage to administer at the right time. Patients can be advised by the nurses on how to take their medication and when to do so, and possible interactions between two or more drugs can be explained to the patient. Medication management minimizes the occurrence of mistakes and improves compliance (Varkey, Cunningham, & Bisping, 2007).

4. Effectiveness of Nursing Interventions
4.1 Summary of Key Findings from the Literature

Regarding the medication adherence of diabetic patients, various nursing interventions have proved to be effective. The literature points to the fact that such interventions not only increase the level of adherence but also improve glycemic control and other aspects of health. The following are the general categories of interventions: educational, behavioral, technological, supportive, and pharmacological; however, the efficacy of adherence interventions depends on the specific context and the way they are delivered.

For instance, a meta-analysis of DSME programs revealed that patients who received such programs had better medication compliance and glycemic control than those who did not (Chrvala et al., 2016). Likewise, motivational interviewing and cognitive behavioral interventions show considerable enhancement in patient compliance and health-related behaviors (Sapkota et al,2015; Nicolucci et al., 2012).

4.2 Comparative Effectiveness of Different Intervention Types

Different types of interventions are compared to show that integrated interventions are the most efficient ones. In the case of knowledge and adherence, educational interventions can go a long way; however, when behavioral strategies are incorporated, the effectiveness is even higher. For example, integrating motivational interviewing into education increases patients' attendance and compliance (Rollnick et al., 2008).

Mobile applications, telehealth, etc., are continuous support and promptness, which is more suitable for young people and those familiar with the technologies. Such tools can be used to fill the gaps between healthcare appointments and sustain compliance in the long run (Aronson, 2018). However, their efficacy can be somewhat restricted by the availability and use of technology by the patient and the patient's level of computer literacy. The social support interventions include peer support groups and family engagement which play a vital role in offering emotional and practical assistance. These interventions are very useful in community settings where social support is essential in the management of chronic conditions (Lorig et al., 2009). Interventions involving drug prescriptions, for example, reducing the number of doses taken daily, are rather obvious but very effective. Simplification can ease the challenge of multiple doses, thus improving compliance, especially among elderly patients (Claxton et al., 2001).

4.3 Short-Term vs. Long-Term Outcomes

Nursing interventions that are employed in the management of medication adherence may have short-term as well as long-term effects. Such changes are observed in the short term, for instance after

intensive educational sessions or when devices are introduced. For instance, patients who use mobile apps to remind them when to take their medications record improvements in adherence rates right from the time the apps are used (Lee et al., 2016).

Long-term results, on the other hand, are only possible if there is a long-term intervention and follow-up. Behavioral and supportive interventions are usually more effective and long-lasting as they encourage individuals' self-motivation and provide them with sustainable resources. Such long-term investigations of peer support groups and regular counseling sessions show continued enhancements in adherence and health status for several years (Heisler et al., 2010).

4.4 Case Studies and Examples
Case Study 1: Diabetes Self-Management Education (DSME) Program
A DSME program conducted in a community health center was a nurse-led group education session that occurred once a week for six months. It consisted of educational presentations, goal setting and goal-attainment discussions, and other group activities. Increased medication compliance was also observed at 25 percent in the participants compared to a control group and HbA1c levels were also significantly reduced (Chrvala et al., 2016).

Case Study 2: Motivational Interviewing in a Primary Care Setting
In a primary care setting, motivational interviewing by specially trained nurses with diabetic patients was offered for three months. The intervention increased the level of medication compliance by 30% and had better glycemic control compared with standard care (Rubak et al., 2005).

Case Study 3: Mobile App for Medication Management
Patients utilized a mobile application intended for diabetes treatment that includes features for medication and education, as well as monitoring tools for over a year. The app also helped to increase the rate of compliance with the recommended treatment plans; users of the app were noted to have better HbA1c levels and fewer hospitalizations than non-users (Lee et al., 2016).

Case Study 4: Peer Support Group Initiative
Diabetic patients formed a peer support group in a rural area, and it was implemented by the nurses. For more than one year, participants had monthly sessions, exchanged experiences, and got educational assistance. This intervention led to maintenance of the positive changes in medication compliance and self-confidence (Lorig et al., 2009).

5. Challenges and Barriers to Implementation
The process of delivering the nursing interventions aimed at enhancing medication adherence in patients with diabetes is not without several barriers, which are patient-related, system-related, and nurse-related. Some of the barriers that are attributable to the patient include psychological barriers such as patient resistance and social demographic factors. On the psychological level, the patient may be afraid of the side effects of the medications, denial of the severity of the condition, or hopelessness which are some of the reasons for non-adherence (Gonzalez et al., 2008). These psychological barriers therefore need to be dealt with gently to address the patients' fears and misconceptions.

Other challenges include low income, lack of health insurance, and inadequate healthcare facilities which are all related to the socioeconomic status of the patients. Lack of funds to buy medicines or to pay for follow-up appointments can make the patient default on the prescribed treatment schedule (Shrivastava et al., 2013). In addition, such factors as transportation problems and geographic remoteness can also interfere with the availability of required healthcare services and, therefore, worsen medication compliance issues.

System-related barriers include difficulties that exist within the overall framework of the health care system. Lack of proper healthcare facilities especially in rural or remote areas or shortage of healthcare providers can hinder the provision of consistent interventions meant to enhance medication

compliance (Sokol et al., 2005). Also, resource constraints such as inadequate financial resources to support healthcare programs and a scarcity of healthcare equipment and commodities may affect the sustainability and efficacy of intervention endeavors in the long run (Presley B. et al,2018). Nurse-related barriers also have an important influence on the effectiveness of the interventions. Lack of adequate preparation in patient education and counseling as well as inadequate exposure to technological tools hinders the nurses' ability to adequately engage with the patients and provide customized interventions (Heisler et al., 2010). Lack of communication skills training and support can lead to poor communication between the nurses and patients regarding medication compliance, inability to track the patient's progress properly, and inability to handle patients' concerns appropriately. However, high workload and burnout among nurses are other factors that also affect the implementation of the strategies. The high number of patients, paperwork, and burnout can take away the time and focus required to educate and encourage patients to take their medications as prescribed (Poghosyan et al., 2010). These nurse-related barriers should be solved with the help of organizational support, such as workload interventions, professional development, and well-being and job satisfaction promotion.

6. Best Practices and Recommendations
6.1 Evidence-Based Strategies for Improving Adherence
The approaches to enhancing medication compliance in patients with diabetes are based on the best practices that target general and individual barriers. That is why patient education becomes one of the key components, which focuses on the need for proper explanations of the treatment process, medicinal prescriptions, and possible consequences (Chrvala, Sherr, & Lipman, 2016). Education should be patient-specific and delivered in a culturally appropriate way and at an appropriate level according to the patient's health literacy (Williams et al., 2014)
Other components include behavioral techniques like motivational interviewing and cognitive behavioral techniques. Such approaches assist patients in addressing psychological issues, enhancing their self-efficiency, and learning practical techniques for diabetes care and compliance with the prescribed therapies (Sapkota et al,2015; Nicolucci et al., 2012). Goal setting and action planning also assist in adherence by helping patients set realistic health goals and monitor their achievements over time (DeWalt et al., 2009). Telemedicine, applications, and EHR integration are the available technological solutions that help in ongoing tracking and support. They improve the relations between the patient and the medical staff, provide immediate alerts, and support data analysis for better adherence and health status (Piette et al., 2000; Lee et al., 2016; Fischer et al., 2010).

6.2 Integrative Approaches Combining Multiple Interventions
Multimodal methods which include educational, behavioral, and technological methods have been found to have a synergistic effect when it comes to medication adherence. For instance, integrating patient education with motivational interviewing increases patient involvement and self-management practices resulting in improved adherence and glycemic control (Rollnick, Miller, & Butler, 2008). Mobile apps for medication reminders are more effective when used adjunctively to regular counseling sessions that provide individualized support and motivation, as well as address patient-level and systems-level barriers (Lee et al., 2016).
In addition, the use of supportive measures including peer support groups and family engagement in the development of a comprehensive patient care plan can help enhance patients' support. Peer support offers encouragement and role modeling, while family engagement offers support and practical assistance in dealing with diabetes and compliance with prescribed regimens (Lorig et al., 2009; Rosland et al., 2010).

6.3 Recommendations for Clinical Practice
In clinical practice, healthcare providers should focus on patient- and family-centered care, which includes patient- and family-centered goals and decision-making. Education, counseling, and support

are major tasks of nurses to guarantee that the interventions are adjusted to the patient's needs and preferences (Heisler et al., 2010). Evaluating psychological, socioeconomic, and logistical barriers to adherence during routine follow-up allows for the identification of issues requiring intervention, and modification of the patient's care plan to optimize adherence and subsequent health gains (Gonzalez et al., 2008). Training of healthcare workers should also entail information on how to promote adherence to medications among patients. Professional development activities such as motivational interviewing, health literacy, and the use of technologies make sure that nurses can implement the necessary interventions (Poghosyan et al., 2010).

6.4 Policy and Organizational Recommendations
Policymakers and healthcare organizations should consider the following policy interventions for effective diabetes management and medication adherence. This entails promoting reimbursement policies that would encourage patient education and adherence promoting interventions and incorporating adherence measures into quality improvement initiatives (Sokol et al., 2005).

Supervisor and/or organizational support is essential in the process of delivering and maintaining interventions. This entails the provision of resources for staff development, hardware and software support, and interprofessional teaming. The integration of EHR and the use of telehealth platforms in care delivery improves the communication between the members of the healthcare team and the continuity of care for patients with diabetes (Fischer et al., 2010). Therefore, it is crucial to incorporate evidence-based practices, combine different techniques, and focus on the patient's needs to enhance medication compliance in diabetic patients. Guidelines for the clinical management of diabetes stress individualization of care, sustained support, and education whereas policy and organizational implications highlight the need for the provision of adequate resources for the improvement of DM outcomes optimally.

7. Future Directions and Research Needs
7.1 Research Gap
The following gaps are evident in the current literature on nursing interventions for enhancing medication compliance in diabetic patients: However, one major area that remains underdeveloped is the provision of more rigorous data on the durability of the interventions for adherence. Most investigations are concerned with the short-term effects of interventions, including changes in the level of adherence rates or glycemic control, while the sustainability of such changes over a long period is not evaluated (Heisler et al., 2010).

Furthermore, there is no clear understanding of the optimal sets of interventions targeted at particular patient groups and healthcare facilities. Despite the positive results of integrative approaches that include educational, behavioral, and technological interventions, more studies are still required to identify the best practices for different population subgroups such as elderly patients, patients with comorbidities, and patients of different cultural backgrounds (Lorig et al., 2009).

7.2 Emerging Trends and Technologies
New developments in technologies in the health sector offer possibilities to improve medication compliance programs for diabetic patients. For example, telehealth solutions remain relevant and are developing new opportunities for remote monitoring, patient education, and instant support. AI and machine learning are seen as having the ability to identify patient compliance and tailor interventions according to the patient's behavior and health information (Lee et al., 2016).

mHealth applications are evolving to be more complex with features like medication adherence, health education, and self-assessment. These apps may enhance patient involvement and compliance, particularly in patients who are familiar with technology, but there are issues related to the equal availability of technology and the patient's level of literacy (Aronson, 2018).

7.3 Suggested Areas for Future Studies

The following areas should be the focus of future research to fill the existing gaps and build on the existing trends. Firstly, more long-term research should be conducted to assess the maintenance of the effects of nursing interventions on medication compliance and patients' outcomes in the long run. These studies should include patient-reported outcomes, healthcare utilization data, and cost-effectiveness analyses to give a broader perspective of the long-term effects of adherence interventions (Sokol et al., 2005).

Secondly, comparative effectiveness research can help identify which of the nursing interventions used in this study result in the most significant improvements in medication adherence among different patient groups and in various healthcare settings. Comparative evaluations should not only focus on therapeutic efficacy and mortality rates but also on patients' satisfaction, their quality of life, and the utilization of healthcare resources to develop evidence-based practice protocols (Presley B. et al,2018)

Finally, it is important to examine the part played by social determinants of health in the use of medication. More research can be conducted on how adherence behaviors are influenced by socioeconomic status, cultural beliefs, and social support systems to design effective interventions that target these determinants of behaviors (Gonzalez et al., 2008).

Therefore, future research on nursing intervention on medication adherence in patients with diabetes should focus on the areas that are still unknown, incorporate modern technologies, and focus on the patient-centered approach. Thus, by considering these future directions and research needs, healthcare providers can improve their capacity to help diabetic patients maintain the best health status and follow the prescribed medications properly.

8. Conclusion

From the literature on nursing interventions that have been implemented to increase medication compliance in patients with diabetes, it can be seen that a complex approach is needed when dealing with this chronic disease. The review has also described various successful interventions practiced by the nurses such as educational, behavioral, technological, and supportive interventions. These interventions have significant roles in providing the patient with information, increasing self-care abilities, and increasing the level of compliance with medications.

Teaching is identified as the most fundamental aspect in the care of patients since it empowers them with the required knowledge on medication compliance and diabetes self-management. Motivational interviewing and goal setting are some of the behavioral approaches that support educational interventions because they target psychological factors and ensure long-term behavioral change. On the other hand, emerging technologies like telehealth applications and mobile health platforms present opportunities for remote monitoring, feedback, and real-time support, which would enhance engagement and adherence among patients. However, there are still some barriers to implementing the results of the research in the practical work of clinicians. Other barriers associated with the patient include the economic status of the patient and psychological barriers that hinder the level of adherence to the prescribed dosage. The system-related barriers such as healthcare system constraints and resource scarcity call for continuous improvement of sustainable interventions and policies.

For future research considerations, more emphasis should be placed on longitudinal studies to evaluate the long-term impact of nursing interventions on medication adherence and clinical outcomes. Comparative effectiveness research can also help to identify what intervention strategies are most effective for which patients in which settings. Also, examining the effects of social determinants of health on medication adherence and incorporating these findings in practice guidelines will be important in closing gaps and enhancing patient outcomes. Therefore, nursing interventions are central to increasing compliance with medication in diabetes patients and the overall health status of patients. Thus, by following the best practices, using new technologies, and promoting favorable policies, healthcare providers can further improve diabetes management and patients' outcomes in terms of glycemic control and overall health.

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