PERSONALIZED HEALTHCARE AS AN INDICATOR OF PATIENT RESILIENCE

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ABSTRACT

Personalized healthcare, tailored to individual characteristics, has gained prominence in the modern healthcare systems. This comprehensive review explores the various aspects of personalized healthcare and its impact on patient resilience.

The review incorporates a synthesis of literature from multiple disciplines, including genetics, psychology, nutrition, and environmental factors. It analyzes the role of personalized health care in enhancing patient resilience, considering genetic predisposition, psychological aspects, nutrition, environmental influences, individualized treatment plans, treatment outcomes, challenges, and future directions.

Genetic analysis is crucial for identifying patients' predispositions and making personalized treatment decisions. Psychological factors significantly influence patient resilience, with adaptable therapeutic approaches to enhance psychological resilience. Personalized dietary recommendations, based on individual needs and genetic factors, improve overall health. Environmental factors, such as air quality and stress, impact patient well-being, and personalized care involves monitoring and reducing these risks. Integrating these aspects into individualized treatment plans leads to improved outcomes and quality of life. Real-world examples confirm the effectiveness of personalized healthcare in strengthening patient resilience.

Personalized health care plays a vital role in enhancing patient resilience. It offers tailored treatment plans that address individual characteristics, resulting in improved treatment outcomes and quality of life.

Keywords: personalized health care, indicator, resilience, patient

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INTRODUCTION

Personalized healthcare represents a comprehensive approach to patient care, taking into account individual characteristics, including genetic predispositions, psychological needs, dietary habits, and environmental factors. This innovative paradigm allows the provision of care tailored to each individual patient, thereby improving treatment outcomes and quality of life. In this review article, we will explore various aspects of personalized healthcare, including its role in strengthening patient resilience and improving their overall health. In recent years, the popularity of personalized healthcare has been growing, emphasizing an individual-focused approach. This approach adjusts medical interventions and treatments according to the unique characteristics, preferences, and needs of patients, including genetic, psychological, nutritional, and environmental factors (1). The goal of personalized care is to integrate these factors into treatment plans to achieve the best results. Resilience, on the other hand, signifies the ability to adapt and recover from challenges and is crucial for physical and mental health (2). In the context of personalized care, resilience training can improve a patient's ability to cope with challenges during treatment (3). Although different, personalized care and resilience intertwine. Personalized care tailors interventions to meet the needs of patients, while resilience refers to their ability to adapt to difficult situations. Healthy lifestyle changes and preventive approaches can improve resilience and overall health status, and personalized care supports these efforts. Accordingly, personalized care and resilience are crucial for enhancing well-being in modern healthcare systems, enabling patients to play a more active role in managing their health. Today's healthcare systems face challenges such as an increased prevalence of chronic diseases and limited resources. In this context, personalized healthcare becomes key to improving the quality of care and therapeutic effectiveness. This innovative practice is based on recognizing the unique needs of each patient, adjusting treatments and therapies. By analyzing genetic, psychological, and nutritional factors, healthcare professionals develop personalized treatment plans, achieving not only effective therapy but also a reduction in side effects. Emphasizing prevention and early detection of potential risks facilitates timely action, preventing the development of serious conditions. Personalized care reduces exposure to risks and improves health by monitoring environmental factors and providing individualized nutritional

recommendations. This practice benefits not only patients but also the healthcare system, reducing costs and improving satisfaction for both patients and healthcare professionals. Personalization of care is crucial for a modern healthcare system, enabling better treatment outcomes, cost reduction, and satisfaction for all involved parties (4). The aim of this paper is to describe personalized healthcare as an indicator of patient resilience.

Genetics and personalized healthcare

Genetic tests and analyses have revolutionized personalized healthcare by providing valuable insights into an individual's genetic makeup and its impact on health. Identifying specific genetic variations allows healthcare professionals to tailor prevention, early detection, and treatment strategies for various diseases. Pharmacogenetic tests are crucial tools in personalized medicine, analyzing how genetic variations affect the way a patient metabolizes certain drugs. This information enables healthcare professionals to adjust medication doses for optimal therapeutic effects while minimizing side effects (5). For example, the Consortium for Clinical Pharmacogenetics provides guidelines for CYP2C9 and VKORC1 genotypes to guide warfarin dosing, reducing the risk of medication side effects (6).

Another application of genetic tests in personalized care is assessing the risk of hereditary diseases. Patients can undergo genetic testing to determine their genetic risk for conditions such as breast cancer, Alzheimer's disease, or Huntington's disease. Early identification of genetic predispositions allows proactive interventions and monitoring, enabling timely treatment and disease management (7,8).

Genetic tests can also provide valuable insights into an individual's response to specific nutrients. By analyzing an individual's genetic structure, healthcare professionals can determine how they metabolically react to certain nutrients. This information can be used to develop personalized dietary recommendations that improve nutrition and reduce the risk of diseases (9,10). Genetic tests can help identify inherited variations in drug response. By examining an individual's genetic profile, healthcare professionals can determine how their genes influence their response to certain medications. This knowledge allows the avoidance of drugs that may cause side effects, ensuring safer and more effective treatments (11).

Genetic tests in personalized care enable more precise diagnosis, treatment, and disease prevention. Understanding genetic

predispositions empowers patients to make informed decisions and take proactive measures to reduce risks. Integrating genetic information tailors approaches, increases well-being, and minimizes the risks of medical interventions. Whether for adjusting drug doses, assessing disease risks, or optimizing nutrition, these tests empower healthcare professionals to provide personalized care. Harnessing genetic information allows patients to play an active role in managing their health, promoting effective prevention, early detection, and disease treatment.

Psychological aspects of resilience

Psychological factors significant for patient resilience encompass genetics, self-efficacy, optimism, social support, and coping abilities. Self-efficacious patients, with faith in their ability to cope with stress, often exhibit higher levels of resilience (12), while optimism enables more effective crisis management and maintaining a positive perspective (13). Social support, from family, friends, and healthcare professionals, is crucial for a sense of belonging and emotional support (14). Coping abilities, including strategies such as problem-solving skills and emotional regulation, also significantly contribute to resilience, allowing patients to effectively manage emotions and maintain a sense of control (15).

Therapeutic approaches to enhancing mental resilience are tailored to individual patient needs to encourage their development and strengthening of resilience. Some commonly used approaches include:

- Cognitive-Behavioral Therapy (CBT): Focuses on recognizing and changing negative thought and behavior patterns, collaborating with patients to develop effective coping strategies (16).
- Positive Reframing Therapy: Highlights redirecting attention to positive aspects and solutions, promoting optimism and self-confidence (17).
- Mindfulness and Meditation Techniques: Promote emotional regulation and stress reduction, enabling patients to have a more adaptable and resilient response to stressors (18).
- Psychoeducation: Key for increasing resilience, educates patients about psychological factors and provides information on coping strategies (19).
- Group Therapy and Support: Beneficial for sharing experiences and peer support, providing a supportive environment for

collective resilience development (20).

By applying these therapeutic approaches, healthcare professionals can support patients in developing coping mechanisms, achieving greater resilience, and realizing improved mental health outcomes.

Nutrition and resilience

Nutrition plays a crucial role in maintaining health and strengthening patient resilience. A well-balanced diet providing necessary nutrients can positively impact both physical and mental well-being. Nutrients such as vitamins, minerals, and antioxidants play a key role in supporting the immune system. Research has shown that individuals with a balanced diet are often less susceptible to infections and diseases, leading to increased resilience (21). Conversely, nutritional deficiencies can weaken the immune system and diminish the body's ability to fight pathogens and recover from illness (22).

Maintaining a healthy body composition and optimal weight through proper nutrition is crucial for resilience. Studies have shown that individuals maintaining a healthy body weight and well-balanced diet have a reduced risk of chronic diseases such as cardiovascular diseases, diabetes, and obesity (23). Healthy body composition and appropriate energy levels also contribute to increased physical endurance and overall resilience (24).

The impact of nutrition on mental health and emotional resilience is increasingly recognized. Research indicates that certain nutrients, like omega-3 fatty acids, vitamin B, and minerals such as zinc and magnesium, play a role in reducing the risk of depression, anxiety, and other mental health disorders (25). A diet rich in these nutrients, along with a variety of fruits, vegetables, and whole grains, can support psychological well-being and increase resilience.

Consuming a diverse diet is crucial for obtaining a wide range of nutrients that support overall health and resilience. Different types of foods contribute to better supplies of essential vitamins, minerals, and phytochemicals, each having various protective effects on the body (26). Incorporating a diverse range of fruits, vegetables, whole grains, lean proteins, and healthy fats into the diet ensures a comprehensive intake of nutrients that support resilience. Personalized dietary recommendations are tailored to patients' unique characteristics, aiming to optimize their health and increase resilience. Here are a few examples of personalized dietary recommendations for different patient groups, with references from studies:

- Patients with chronic diseases (such as diabetes, cardiovascular diseases, or gastrointestinal issues) require customized meal plans. For example, diabetes patients may benefit from blood sugar control through proper carbohydrate counting and choosing low-glycemic-index foods (27).
- Athletes and active individuals need special nutritional needs that support endurance, performance, and recovery. This includes adequate protein intake for muscle recovery, sufficient carbohydrate intake for energy, and hydration strategies (28).
- Pregnant and lactating women have unique needs to support fetal development and child health, including increased intake of folate, iron, calcium, and omega-3 fatty acids (29).
- Children and adolescents need personalized recommendations for proper growth and development, including intake of essential nutrients such as calcium, vitamin D, iron, and omega-3 fatty acids (30).
- Older adults require nutrition that supports the preservation of muscle mass, reduces the risk of falls and fractures. Personalized recommendations include appropriate protein intake, calcium, vitamin D, and strategies to address specific issues related to aging (31).

These approaches encompass personalized diets, meal plans, and monitoring to ensure patients receive the necessary nutrients. This achieves the optimization of dietary intake, supports overall health, and improves resilience in various patient populations.

Environmental factors and health

The impact of environmental factors on patient health is crucial, shaping physical and mental well-being. Air quality has a significant impact, with poor air quality increasing the risk of respiratory and cardiovascular diseases, especially in patients with pre-existing respiratory conditions. Reducing exposure to pollutants, using clean energy sources, and enforcing air quality regulations are crucial for maintaining health. Clean and safe water is vital for preventing infectious diseases (32). Maintaining a safe water supply involves monitoring water sources, water treatment, and promoting hygiene practices.

Stressful environments significantly affect mental and physical health, increasing the risk of various problems (33). Personalized care needs to identify and address sources

of stress, including stress management techniques, social network support, and promoting a balance between work and personal life.

These environmental strategies in personalized care can significantly improve patient health. Personalized healthcare includes monitoring and reducing environmental risks. Examples of approaches to this goal include:

- Accurate monitoring of exposure: Healthcare professionals use sensors and monitoring systems to assess patients' exposure to harmful substances. This allows the identification of potential risks and guides interventions to reduce exposure.
- Patient education: Informing patients about environmental risks and ways to protect themselves enables them to make informed decisions about their environment. Education about the importance of clean air, safe water, and stress reduction techniques encourages proactive steps toward a healthier environment.
- Risk reduction interventions: Developing strategies to reduce environmental risks is crucial in personalized care. This includes improving air and water quality, policy changes, stress reduction programs, promoting green practices, and advocating for environmental health protection regulations.
- Increasing awareness of environmental factors: Healthcare providers play a role in educating about the impact of environmental factors on health. They encourage responsible behavior towards the environment, supporting initiatives such as waste reduction and resource conservation for a healthier and more sustainable future.

Monitoring and reducing environmental risks are crucial for creating a safe and healthy environment, supporting patients in achieving optimal well-being and resilience (34).

Personalized treatment plans

Incorporating all aspects into a personalized treatment plan requires a comprehensive patient assessment. This assessment includes genetic analysis to identify potential genetic predispositions or markers that may influence the selection of appropriate therapies. Psychological assessments help identify underlying mental health conditions or stressors that may require special attention. Analyzing dietary habits plays a crucial role in

understanding patient needs and identifying changes in nutrition that may be necessary for health optimization. Additionally, analyzing environmental risk exposures, including air and water quality, aids in developing strategies to reduce potential risks. After completing the assessment, specific treatment goals are set, tailored to individual patient needs. Customized therapeutic approaches, including pharmacogenetic strategies, psychotherapy, stress management techniques, and personalized dietary recommendations, are applied. Planning for environmental risk reduction, such as improving air and water quality, is integrated into the overall treatment plan. Continuous monitoring through regular check-ups ensures the effectiveness of the treatment plan, allowing adjustments as needed to achieve the best outcomes for the patient (35).

Results of personalized healthcare and resilience

Analyzing the treatment outcomes and quality of life of patients undergoing personalized care confirms the integration of all the mentioned aspects into practical applications. Successful individualized treatment plans affirm the importance of adapting treatment plans according to individual patient needs. Personalized healthcare, considering genetic predispositions, psychological, nutritional, and environmental factors, provides comprehensive and effective care. Key analyses of treatment outcomes and quality of life in personalized care assess the effectiveness of this approach through various studies.

Research has shown that personalized care can reduce the risk of developing hereditary diseases or chronic conditions, encouraging positive lifestyle changes in patients. Specifically, tailored insulin therapy based on genetic and clinical factors improves blood sugar control in diabetes patients (36). Studies have also confirmed the positive impact of personalized care on patients' quality of life, enhancing emotional well-being, physical health, and overall life satisfaction. Interventions tailored to cancer patients have led to improved psychological well-being and reduced treatment side effects (37).

Moreover, analyses have highlighted that personalized care significantly contributes to reducing hospitalizations and complications, especially in patients with chronic conditions (38, 39). Comparisons between personalized care and traditional approaches consider key factors, exploring its effectiveness, side effect reduction, and economic efficiency. Research has shown that personalized care can be more effective than traditional therapies,

improving patient outcomes in various conditions (40). Additionally, tailoring treatment to individual characteristics can reduce treatment side effects, improving treatment adaptability and resulting in enhanced outcomes (41). Economic efficiency is also a significant aspect, with studies showing that personalized care can lead to cost savings and improved healthcare quality. Analyses have revealed that targeted interventions based on personalized medicine can result in reduced healthcare costs (42).

When considering treatment outcomes and quality of life in personalized care, studies show a reduced risk of diseases, improved disease control, better quality of life, and reduced hospitalizations and complications. Comparisons with traditional approaches confirm the advantages of personalized care in treatment effectiveness, side effect reduction, economic efficiency, and improved quality of life, emphasizing the importance of personalized healthcare in achieving better outcomes and promoting patient resilience.

Challenges and future of personalized care

Current research shows that the implementation of personalized care faces challenges such as high costs and uneven availability of genetic analysis, psychological assessments, and personalized therapies. Additionally, the requirements of personalized care involve the complex integration of diverse data with secure information exchange. Collecting and analyzing genetic data raise questions about privacy and ethics, while healthcare professionals need training to apply this approach (45,46).

Despite these challenges, the future of personalized healthcare promises technological developments and innovations that will overcome existing obstacles. Advances in genetics and biochemistry will enable even more precise personalized therapies (47). Telemedicine and mobile applications will allow health monitoring and personalized recommendations via the internet (43). Research on the impact of diet on health will contribute to the development of personalized nutrition plans (46). The application of artificial intelligence and machine learning will improve the analysis of genetic data and support personalized diagnosis and therapy (45,48). Patient and healthcare worker education on personalized care will become crucial for understanding and accepting this approach (44).

The future of personalized care brings innovations that will improve patient care and enhance their resilience and health. It is important to actively address the

challenges in implementing personalized care to make it accessible to all patients. Practical examples and case studies of personalized healthcare provide insights into how treatment customization can enhance patient resilience:

- Personalized treatment plans in Oncology: Genetic analysis of tumors in cancer patients allows the identification of specific mutations, influencing the selection of the most effective treatment. For example, a study in the New England Journal of Medicine showed that personalized treatment based on genetic analysis improved outcomes in patients with advanced melanoma (49).
- Pharmacogenetic adjustment of therapy: Genetic tests help determine optimal doses and types of medications for patients taking drugs like antidepressants or antipsychotics. Pharmacogenetic testing has led to improved treatment outcomes and reduced healthcare costs for patients with depression (50).
- Personalized diets for disease treatment: Patients with chronic conditions, such as diabetes or cardiovascular diseases, benefit from personalized nutrition plans. A study showed that personalized nutrition counseling improved glycemic control and weight loss in patients with type 2 diabetes (51).
- Psychological support and therapy: Adapting therapeutic approaches based on patients' psychological characteristics achieves better outcomes. Personalized cognitive-behavioral therapy improved results in patients with generalized anxiety disorder (52).

These examples illustrate how personalized healthcare, considering genetic, psychological, and nutritional factors, along with treatment adaptation, can significantly improve patient resilience and treatment outcomes. In recent years, resilience has become highly relevant in our environment, with numerous studies and expert papers published on this topic (52,57).

CONCLUSION

Personalized healthcare represents a revolutionary approach that encompasses genetic, psychological, nutritional, and environmental factors to provide individualized support to patients. Key findings point to the potential of personalized care to improve patient outcomes through genetics, psychological support, nutrition, and environmental risk management.

Examples from practice illustrate the positive impact of personalized care on patients' quality of life, reducing the risk of diseases, improving disease control, and minimizing therapy side effects. Further research into the mechanisms of personalized care and its impact on patient resilience is recommended. Integration of genetic testing into routine care, healthcare professional education, and monitoring technological innovations are crucial steps to enhance healthcare. Ultimately, personalized healthcare holds the potential for a revolutionary improvement in health outcomes and patient resilience.

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PERSONALIZIRANA ZDRAVSTVENA NJEGA KAO POKAZATELJ REZILIJENCIJE PACIJENTA

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SAŽETAK

Personalizirana zdravstvena njega, prilagođena individualnim karakteristikama, dobila je značaj u modernim zdravstvenim sustavima. Ovaj opsežni pregled istražuje različite aspekte personalizirane zdravstvene njege i njen utjecaj na rezilijencija pacijenata.

Uključuje sintezu literature iz više disciplina, uključujući genetiku, psihologiju, ishranu i čimbenike okoliša. Analizira ulogu personalizirane zdravstvene njege u poboljšanju rezilijencije pacijenata, uzimajući u obzir genetsku predispoziciju, psihološke aspekte, ishranu, utjecaje okoliša, individualizirane planove liječenja, ishode liječenja, izazove i buduće smjernice za održanje personaliziranog pristupa kao pokazatelja rezilijencije bolesnika.

Genetska analiza ključna je za prepoznavanje predispozicija pacijenata i donošenje personaliziranih odluka o liječenju. Psihološki čimbenici značajno utječu na otpornost bolesnika, s terapijskim pristupima prilagodljivim za poboljšanje psihičke otpornosti. Personalizirane prehrambene preporuke, temeljene na potrebama i genetskim čimbenicima, poboljšavaju opće zdravlje. Čimbenici okoliša, poput kvalitete zraka i stresa, utječu na dobrobit pacijenata, a personalizirana skrb uključuje praćenje i smanjenje tih rizika. Integracija u individualizirane planove liječenja dovodi do poboljšanih ishoda i kvalitete života. Primjeri iz stvarnog svijeta potvrđuju učinkovitost personalizirane zdravstvene skrbi u jačanju otpornosti pacijenata.

Personalizirana zdravstvena njegaigra ključnu ulogu u poboljšanju rezilijencije pacijenata. Nudi prilagođene planove liječenja koji se bave individualnim karakteristikama, što rezultira poboljšanim ishodima liječenja i kvalitetom života.

Ključne riječi: personalizirana zdravstvena njega, indikator, rezilijencija, bolesnik

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