

Digital Transformation of Preservation and Restoration of Ukraine's Cultural Heritage

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Abstract

Digital transformation of the preservation and restoration of Ukraine's cultural heritage plays a key role in the national and patriotic education of the people and in ensuring the country's territorial integrity. As a result of the war in Ukraine, a significant number of cultural sites were damaged and destroyed. Therefore, there is a need for their digital registration and further restoration through the use of digital technologies. The article aims to study the principles of digital transformation and possible improvement of the quality of the cultural level in Ukraine and to define the Ukrainian idea through the dissemination of culture, in particular, through educational activities. Given the current trends in the penetration of digital technologies into all spheres of life, their use in the cultural sphere can help boost morale and serve as a tool to combat Russia's expansive cultural rhetoric. The article focuses on the peculiarities of digital transformation, the main means of its implementation, and possible further development. The results of the study indicate the need to use digital technologies as a tool for reconstruction and a means of information protection of the most important cultural sites. The article draws attention to the public administration policy and the problems of financing cultural monuments and objects as the main means for possible further digital transformation. The findings of the study may be useful for further analytical research on the use and implementation of digital transformation of cultural heritage in Ukraine.

Keywords: digital transformation, digital technologies, cultural heritage, digital art, national idea, national traditions

1. Introduction

The development of digital technologies leads to an increase in their penetration into all spheres of human activity. The possibility of restoring cultural monuments and special objects is a factor in the development of digital infrastructure and the possibility of using special software (Patay-Horváth, 2014). The cultural situation in Ukraine is currently experiencing increased attention, in particular, due to the war. The issue of creating cultural heritage in digital format plays an important role, as most cultural sites were destroyed during the hostilities, and some were completely lost. Therefore, the most relevant tool for the development and possible dissemination of the cultural component is the formation of a special register that will include key cultural monuments (Moise et al., 2020). The digitalization of such objects has several advantages. First, this practice makes it possible to disseminate information about the country in the global space. Secondly, the availability of digital cultural materials creates an opportunity for high-quality management and use of such monuments. Thirdly, public administration can implement specialized policies aimed at improving these features, as well as become a factor in enhancing the cultural component. Insufficient funding for digital transformation is an important problem, so the issue of finding investors and funds for digital transformation is becoming more relevant. Moreover, specialized software and developed digital infrastructure are needed, which play a leading role in this segment. The use of cultural heritage is important in several ways. It can serve as a factor in countering the information attacks of the

aggressor country at the ideological level, as well as a means of boosting the morale and resilience of the Ukrainian people. In such circumstances, conducting an analytical study of the peculiarities of digital transformation and its implementation in the modern Ukrainian space is the most relevant and appropriate research issue.

2. Literature Review

The peculiarities of the development of digital transformation of cultural heritage for its restoration and preservation have been studied by many scholars from the perspective of using digital technologies and public administration tools to stimulate such activities (Rebec et. al., 2022). According to Acke (Acke 2021), modern cultural development is gradually moving to the digital age. This creates a need for technologies that provide access to cultural monuments and objects based on digital platforms. According to Bruno (Bruno 2015), the cultural heritage of any country should be digitized. This makes it possible to monitor its condition, conduct special analytical historical research, and use such resources to improve the quality of information circulation (Trehub, 2019). According to Dychkovskiy (Dychkovskiy 2019), the importance of using digital technologies in the cultural sphere is also due to the evolution of humanity towards digital technologies. The use of digital technologies is a prerequisite for the development of scientific and technological progress, which is partially reflected at the sociocultural level (Kennedy et. al., 2013; Rodrigues et. al., 2014). Galantucci (Galantucci 2018) notes that the practice of digitalization of culture is carried out based on effective public administration and the use of special tools to control and stimulate such activities. According to Laak (2020), public administration in the field of culture requires high-quality monitoring and the ability to implement its policies aimed at improving the cultural component. According to Kolokoussis (Kolokoussis 2021), this will help improve the quality of the historical component of the state. According to Gorbul (Gorbul 2022), there is an urgent need for the formation of a highly spiritual culture in modern Ukraine. Moreover, its spread on a global level is a prerequisite for confronting the aggressor country and winning an ideological victory. According to Rusakov (Rusakov 2022), Ukraine has long fought for its historical identification and the ability to resist Russia's expansive cultural policy. This raises the question of using cultural heritage as an ideological weapon, which directly affects the quality of ideological opinion formation in Ukraine and around the world. According to Mishchenko (Mishchenko 2020), the digital transformation of cultural heritage is possible only if there is a strong digital infrastructure. It is noteworthy that besides the restoration of certain cultural monuments, there is the issue of their preservation and dissemination. For these processes, according to Hlushchuk (Hlushchuk 2019), special software and opportunities to use cloud technologies and innovations that improve the role of cultural preservation are needed. According to Musiienko (Musiienko 2019), digital transformation should be introduced in any country. Moreover, the corporate sector should become a key instrument for financing such a policy. The participation of the corporate sector in the country's cultural policy can be a factor in improving the living standards of the population and contribute to high morale. Ukraine, according to Karpets (Karpets 2019), has one of the best levels of digital art development in the world, thanks to its strong information sector. However, the country needs adequate funding and opportunities to utilize and showcase its cultural assets around the world. In such circumstances, conducting a study on the digital transformation of cultural heritage preservation and restoration is important and appropriate.

3. Research Aims

The article aims to analyze the digital transformation and restoration of Ukraine's cultural heritage through the use of modern digital infrastructure and innovative technologies. An important issue in the study is the use of cultural sites and monuments as a tool for improving the quality of the national identity of the Ukrainian people and for opposing the aggressor country's aggressive policy at the ideological level. The war necessitates Ukraine's need to improve the quality of the register of damaged cultural monuments, so attention is being paid to them. The use of digital technologies can improve the features of further cultural development. One of the key objectives of the study is to analyze the current features of the use of digital infrastructure and special software for the possible digital transformation of cultural heritage. The results of the study characterize the current prospects and features of the digital transformation of Ukraine's cultural heritage.

4. Methods and Materials

The study used scientific research methods to analyze the peculiarities of using the digital transformation of cultural heritage as a tool for improving the cultural level in Ukraine. In particular, exploratory analysis methods were used to study the theoretical, practical, and methodological aspects of digital transformation as a technology that is a product of mass digitization and is used in the cultural space. This method was also used to search for and analyze information on current practices of using digital technologies for the restoration of cultural monuments and objects in Ukraine. The study pays attention to the methodology of using digital technologies and emphasizes the role of the information sector as a key tool for implementing the policy of digital transformation of cultural heritage. The paper analyzes the peculiarities of the use of digital technologies to create a special register that will list the restored monuments and indicate the main directions for their further development. Based on the synthesis method, the peculiarities of using and implementing digital transformation policy with the help of modern digital tools were investigated. This method was used to identify key areas and factors for the implementation of digital transformation. The article pays attention to the functions of public

administration bodies in Ukraine regarding cultural development as a strategic policy of the state in times of war. The application of such a policy can contribute to Ukraine's ideological victory and serve as a qualitative aspect of countering Russian information attacks. Based on the methods of deduction and induction, the key prospects for the digital transformation of cultural heritage in Ukraine were identified and the directions that can be used for their implementation were given. Thus, the proposed research methodology allows us to determine the following research results.

However, to strengthen the study and provide a more comprehensive understanding, it's essential to acknowledge the limitations that affect the research outcomes. The impact of geopolitical constraints on the study of digital transformation in the context of Ukrainian cultural heritage is profound and multifaceted, particularly during times of war. Geopolitical constraints in regions affected by conflict profoundly impact digital transformation initiatives related to cultural heritage. Addressing these challenges requires innovative solutions, international cooperation, and a deep understanding of the complex interplay between technology, culture, and geopolitics. Ethical concerns related to digital transformation, such as data privacy, cultural sensitivity, and community engagement, are crucial.

5. Results

The development of digital transformation and ensuring the quality of restoration and preservation of Ukraine's cultural heritage is important for both state development and the promotion of cultural and ethnic identity. Cultural development is of paramount importance. Ensuring the cultural heritage of Ukraine, awareness of its national identity, and the possibility of using culture as a tool for the dissemination of Ukrainian culture will serve as key factors in the implementation of the state's strategic policy. To ensure a high cultural level in Ukraine, it is necessary to take into account not only current cultural sites but also historical heritage. With the help of digital modernization, it can become a factor in improving the quality of life of the population from a cultural point of view. Ukraine is at war and needs strong national development. This directly affects the morale of the population, the possibility of winning at the ideological level, and the use of the ideology of Ukrainization as a prerequisite for separation from the aggressor country.

The role of digital technologies is increasing in all areas of socio-cultural and socio-political activities that affect cultural development. In particular, developed countries use digital infrastructure as a tool for restoring the cultural property, which can be in the form of architectural monuments, certain works of art, etc. The use of digital technologies makes it possible to carry out high-quality restoration and recreate the spirit of the historical era. Digital technologies have become widely available to society and affect the general state of economic and household activities. The use of digital technologies can become a factor in raising cultural awareness and become a prerequisite for using them to strengthen the role of cultural heritage and the possibility of using national attributes in the digital space. Strengthening the country's brand can also be done through the use of digital technologies. Moreover, the creation of certain media materials and the digitalization of art can become factors in spreading awareness of national history and the possibility of its dissemination.

For Ukraine, an important strategic issue is the development of its own culture and the popularization of the origin and historical existence of the Ukrainian people, and the formation of society. The importance of this issue stems from political ideals, behind which is the need to use cultural means to overcome Russia's propaganda policy. It was expansive in both territorial and cultural terms. Most of the Ukrainian culture was destroyed or appropriated by the aggressor country. Therefore, pursuing a policy of preserving and restoring cultural heritage is of paramount importance, as the use of such features brings Ukraine closer to victory in the ideological sense. Moreover, for a long time, the issue of the symbiosis of Russian and Ukrainian cultures was perceived in the world as a single entity. Moreover, it was believed that these nations were identical in their characteristics. Therefore, the development of Ukrainian culture is important for overcoming this stereotype. It will contribute to a better understanding of why Ukraine is fighting for the right to independent existence and its territorial integrity.

The importance of using digital technologies is also due to the factor of their penetration into international cultural markets and popularization in society. The advent of the Internet and specialized digital platforms has made it possible to hold online conferences to discuss certain historical issues. However, a key factor in the benefits of digital technologies in the cultural context is the creation and emergence of special digital cultural exhibitions that present works of art, mostly in digital form. The development of such digital museums became a popular practice in 2021 and 2022. This is because most people were unable to physically visit certain cultural institutions due to the spread of the coronavirus pandemic. Therefore, an alternative was the emergence of such digital institutions that allow the dissemination of information about the culture of a particular social society, country, or state or give special symbolic meaning to any other cultural object. In the last three years alone, Ukrainian art has been presented at many digital exhibitions and museums. This is evidence of the rapid development of the Ukrainian national idea, culture, and art. The need to use digital technologies is also driven by the current information war against the aggressor country and the need to prove the uniqueness of Ukrainian culture and its history.

Digital transformation implies the possibility of converting traditional art media into a digital format, which can create conditions for their preservation and the formation of digital registers. An important factor in the use of digital registers as a tool for preserving

and restoring Ukraine's cultural heritage is its key importance, as it provides an opportunity to record and develop existing cultural features in Ukraine. Moreover, the introduction of digital registers is a catalyst for effective public administration. The principle behind the digital registry is to control and monitor cultural processes. Usually, a digital registry has a clear structure and an internal database that stores all the necessary information about a cultural object, such as the year of creation, author, and identity (actual belonging to a particular cultural style or era), as well as information about transformational changes that have occurred in recent years or the presence of certain marks that require attention. The use of such registers for cultural sites in Ukraine is a prerequisite for improving the quality of cultural preservation and provides an opportunity for specialized digital transformation. Furthermore, the digital register provides an opportunity to improve the methodology of public administration, as well as to conduct certain stages of control over the digital transformation. Most of the digital transformation is currently taking place on the initiative of Ukrainian artists, special organizations, and under certain special conditions. However, the role of public administration in the digitalization of Ukraine's cultural heritage remains insufficient. This is due to insufficient funding, a lack of professional staff, and a low level of educational policy. Therefore, it is important to improve these areas as a condition for the digital transformation of Ukraine's cultural heritage and the possibility of bringing them to international standards. Such implementation practices will consider the peculiarities of the cultural development of a particular art form and may influence the formation of social and political opinions. Thus, the key areas for the digital transformation of Ukraine's cultural heritage are shown in Figure 1.

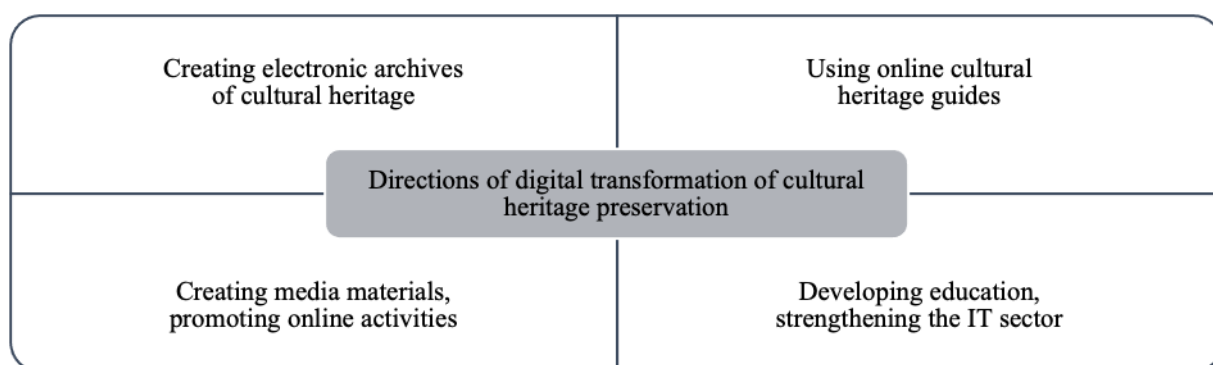


Figure 1. Directions of digital transformation of cultural heritage preservation

Source: compiled by the author.

These directions of digital transformation, shown in Figure 1, indicate the need for the development of a strong information sector in Ukraine. The importance of developing this segment of the economy is linked to its cultural significance due to the possibility of using innovative digital technologies. The use of these technologies will directly affect the quality of reproduction of existing cultural material and ensure the greatest realism in its creation. This practice will serve as a factor in increasing the cost of digital transformation, and can also play the role of a powerful infrastructure for the storage of cultural heritage. The development of digital infrastructure is also linked to security issues. In 2022, according to official data from Ukrainian cultural periodicals, information attacks were carried out on Ukrainian digital platforms to damage data or steal information. This practice became popular during the war and is aimed at damaging Ukraine's national digital assets. To counter this form of aggression, attention should be paid to the use of digital technologies and the creation of data centers to improve the quality of cultural heritage preservation. Equally important is the issue of information protection and access control. Therefore, to improve the quality of information preservation and counteract information attacks, it is crucial to develop the domestic Ukrainian information technology sector.

A key factor in the digital transformation of cultural heritage is the issue of financing and the possibility of accumulating corporate capital in this sector. The problem is that most of the state expenditures are spent on defense and social protection, which makes it difficult to finance culture. Finding alternative sources of funding is a priority for the Ukrainian cultural space, as it can reduce the burden on public authorities and improve the level of cultural dissemination about Ukraine on a global scale. Funding for the digitalization of Ukraine's cultural heritage can be provided by international donor organizations, investment support from EU countries, etc. However, in any case, it is crucial to involve the corporate sector in financing Ukraine's cultural sector. Moreover, the current practice of using and shaping the digitization of cultural heritage can create the preconditions for the emergence of a new digital commodity market that will have a real commercial result for investors. However, in the first stages, the financing of the digitalization of Ukraine's cultural heritage should be carried out based on corporate social responsibility and with an awareness of the importance of business participation in financing such objects as culture. Strengthening Ukrainian culture will be of strategic importance for winning the war. Furthermore, the use of the corporate sector's participation in digital transformation will ensure the process of monitoring and controlling the stages of such activities and the possibility of adjusting them if necessary.

An essential factor for improving the implementation of the digital transformation of cultural heritage is to improve the

quality of education and the organization of the educational process. Such a policy will be driven by two factors. First, it will contribute to a qualitative improvement in the level of education and the ability to use modern information technologies to improve the digital transformation of culture. Moreover, a high level of education contributes not only to the development of educational level but can also become a factor in the realization of the importance of culture and national identity in the public space. To improve the quality of education, it is necessary to implement modern curricula that not only introduce key disciplines but also contain materials about the cultural heritage of Ukraine. An important factor in modern education is the growing demand for specialists with special digital skills. The use of digital technologies is currently a fairly popular practice in any corporate sector, so for the best results, specialized personnel must be trained. There is a shortage of such specialists not only in Ukraine but also around the world. Therefore, the issue of education development remains one of the most important both in the context of ensuring digital transformation and human capital development in Ukraine.

It is equally essential to improve the quality of public policy implementation and management in the field of culture. Reforming the current institutions of governance and decision-making can be a factor in improving the quality of policy implementation for the implementation and development of digital transformation in Ukraine. In particular, the implementation of specialized investment projects may be of particular importance for improving the current state of cultural governance in Ukraine. Moreover, there is a growing demand for Ukrainian culture around the world, which is a factor in improving the quality of digital cultural production. However, the primary task is to restore cultural heritage with the help of digital technologies. The use of this practice makes it possible to familiarize the global public space with Ukrainian history, which is useful both for Ukraine and for strategic policy. Understanding the identity and uniqueness of the formation of Ukrainian statehood is a tool to combat Russian aggression. Therefore, the development of public administration and improvement of cooperation with artistic, cultural, and other organizations is the prerogative of modern politics.

Digital transformation and the restoration of cultural heritage in Ukraine is a complex process. It requires the use of various tools and specialized means to improve the development of digital infrastructure and spread the practice of cultural development in the modern world. Moreover, the implementation of such tools can become a factor in the development and improvement of Ukrainian culture. The tools that can be used in the practice of digital transformation are described in more detail in Table 1.

Table 1. Means of transforming the preservation and restoration of cultural heritage in Ukraine

Means	Characteristics
Strengthening the role of the IT sector in Ukraine	Enhancing the role of the IT sector makes it possible to improve modern information technologies for the preservation and restoration of Ukraine's cultural heritage using digital technologies.
Using modern digital infrastructure	The development of IT facilitates the emergence of cloud services, flexible server settings, and information storage, which is useful in digital transformation.
Creating electronic registers	The use of digital libraries and online registries makes it possible to control the development of the digital transformation of cultural heritage.
Creating media materials and their distribution	The introduction of digital media materials related to cultural heritage will be a qualitative tool for improving the current policy of cultural heritage development.
3D modeling of architectural monuments	The use of modern modeling technologies will contribute to the development of cultural heritage and the preservation of the work of Ukrainian artists.
Organization of digital public administration	The ability to control and monitor the process of using the preservation and restoration of cultural heritage.

Source: compiled by the author.

Based on the proposed areas in Table 1, it can be argued that the current practice of implementing digital transformation needs to be clarified and the role of digital technologies in the cultural segment needs to be strengthened. The use of such principles will have a positive impact on the overall state of cultural development and will contribute to Ukraine's strategic policy of ideological struggle against Russia's expansionist policy.

Thus, it can be concluded that the digital transformation of the preservation and restoration of Ukraine's cultural heritage

is a complex and comprehensive process that requires reforms in the Ukrainian public space, as well as significant investment in the development of the information sector as a key tool for digital transformation. Moreover, the current practice of using digital technologies should be accompanied by special tools aimed at improving and disseminating the specifics of using such technologies. Digital transformation should be based on improving the perception of cultural objects, preserving their essence in the ideological sense, and using digital materials to disseminate and preserve historical accuracy. The Ukrainian cultural sector is developing rapidly. This necessitates the development of digital technologies and the dissemination of practices for transforming existing cultural objects into digital formats.

Thus the digital transformation of Ukraine's cultural heritage is not just a technological advancement; it is a strategic imperative and a powerful tool for preserving the nation's identity and countering ideological threats. By clarifying the current practices, strengthening the role of digital technologies in the cultural sector, and investing in both public reforms and the information sector, Ukraine can safeguard its rich cultural heritage amidst the challenges of the digital age. Emphasizing the accurate portrayal of cultural objects and leveraging digital materials to disseminate historical truths will not only preserve the essence of Ukrainian culture but also contribute significantly to the country's ideological struggle against external influences. As Ukraine continues to rapidly develop its cultural sector, embracing and enhancing digital technologies will not only preserve the past but also pave the way for a more vibrant and digitally connected future, reinforcing Ukraine's unique identity on the global stage.

6. Discussion

The study on the digital transformation of the preservation and restoration of Ukraine's cultural heritage shows the need to improve the quality of these processes in the context of modern digital development, as the use of special digital infrastructure will contribute to the cultural rise and development of the national idea of Ukraine. The importance of the digital transformation of cultural heritage is driven by the need to disseminate the historical process of the formation of the Ukrainian state in the global space. Given the ideological war with the aggressor country, the use of such opportunities is becoming a strategic direction for Ukraine. Further research should be conducted to counter Russian ideological policy and prevent cultural risks for Ukraine. The conditions of war emphasize the importance of culture as a factor of morale, creating effective information warfare and improving the perception of the idea of a united Ukraine by society. The cultural foundation should be formed based on the use of the cultural heritage that Ukraine has accumulated throughout its existence. Such use of cultural heritage will help improve the quality of Ukrainian culture.

An important area for further research should be digital technologies that can be used to carry out the digital transformation of cultural heritage (Rebec et al., 2022). The introduction of technologies such as 3D modeling and specialized graphics can help restore Ukrainian art and improve its perception in the modern world. It is also worth considering that most cultural monuments are currently damaged or in poor condition. To possibly improve their perception, it is necessary to transform the digital state so that the accessibility of cultural heritage is possible for everyone around the world. Moreover, the practice of holding digital exhibitions and creating special museums can become a factor in strengthening the role of digital technologies in reproducing culture. Improving the quality of digital infrastructure can be key to the use of digital registers, special catalogs, and other tools for identifying and inventorying Ukraine's cultural heritage. First, research in this direction can help identify cultural heritage. Secondly, the availability of such a registry makes it possible to implement a policy of monitoring and controlling the process of digital transformation and the current state of its development.

Another important research direction is to ensure the development of education and adequate funding for the cultural sphere (Moise et al., 2020). Education not only improves the professional level of students but also strengthens cultural identity among Ukrainians. Financing culture is one of the most acute problems in the Ukrainian space, as the lack of financial resources leads to some unsatisfactory processes. Therefore, to improve funding, it is necessary to involve the corporate sector in cultural policy, as it can become a donor for the restoration and development of Ukrainian culture. In particular, funding for digital transformation can be provided by international donor organizations. Research on these issues is most appropriate, as their solution will contribute to the development of the Ukrainian cultural digital space.

7. Conclusion

Thus, we can conclude that the use of digital technologies is a key aspect of the development of Ukrainian culture in the modern world. Moreover, the implementation of digital transformation involves the reconstruction of existing cultural monuments to a digital form. The opportunity to improve and restore cultural heritage will be strategic for the Ukrainian national idea, as such use will contribute to the national rise and strengthening of Ukraine's brand on the global stage. An important factor in improving the quality of digital transformation and the possibility of preserving and restoring cultural heritage is the use of tools aimed at preserving the memory of a particular historical era, art, and aesthetics. The importance of using digital technologies is also due to the general policy of digitalization, which is constantly evolving and becoming more and more popular. The introduction of such technologies will help to popularize the Ukrainian national space and

spread the ideology of Ukraine's territorial value, which is an important factor in achieving victory in a war. If we consider the internal situation in Ukraine concerning the policy of digital transformation of cultural heritage, the most important issue is the effective work of public authorities. The public sector of Ukraine, which is engaged in the digital transformation of cultural heritage, should consider funding factors and the possibility of using special innovative technologies that allow for the preservation and most accurate reproduction of cultural monuments. An important factor in the implementation of digital transformation is the issue of information security, as, in 2022 alone, Ukraine was attacked, which had negative consequences for the socio-political space. Therefore, the protection of cultural digital objects should be taken into account when planning digital transformation. Furthermore, improving the quality of education and implementing educational policies will serve as a means of improving and developing a mass culture in Ukraine. It is also important to formulate the main key areas for digital transformation. One of these areas is adequate funding, which can be achieved through the participation of the corporate sector, as it remains the most significant mechanism for financing cultural initiatives in Ukraine. Thus, Ukraine's victory in the ideological issue depends on strengthening the quality of cultural policy, as well as the possibility of digital transformation of cultural heritage.

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Authors contributions

The authors contributed equally to the study. All authors read and approved the final manuscript.

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Data sharing statement

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