

THE IMPACT OF INFORMATION SYSTEMS ON EDUCATIONAL ACHIEVEMENT: A BIBLIOMETRIC STUDY OF PALESTINE

Nebi SEREN¹

Abstract

Education is a fundamental component for developing social, economic, and cultural competencies on an individual level while promoting equality and supporting economic growth on a societal level. This study uses Palestine as a case study to explore the relationship between the academic focus on information systems in education and educational outcomes. In addition, the study examines in detail the educational studies conducted in Palestine. A dataset was constructed by filtering publications in the Web of Science (WoS) database using the keywords 'Palestine' and 'education.' Bibliometric analyses were conducted using Vosviewer, including co-author, keyword, country citation, source citation, and bibliographic coupling analyses. The study further examines the correlation between PISA mathematics scores and the number of academic studies on educational information systems through bivariate analysis. The results indicate a significant positive relationship between the focus on information systems and educational success, highlighting countries that prioritize this area as higher performers in PISA assessments. Finally, recommendations are proposed to enhance the role of information systems in education and their potential economic contributions to Palestine.

Keywords

Education in Palestine
Information Systems
Marketing of Education
PISA Scores
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¹ Öğr. Gör. Dr., Bursa Uludağ Üniversitesi, Orhangazi Yeniköy Asil Çelik Meslek Yüksekokulu, Bilgisayar Teknolojileri Bölümü, e-posta: nebiseren@uludag.edu.tr, ORCID: 0000-0003-4080-4823.

BİLİŞİM SİSTEMLERİNİN EĞİTİM BAŞARISI ÜZERİNDEKİ ETKİSİ: FİLİSTİN ÜZERİNE BIBLİYOMETRİK BİR ÇALIŞMA

Öz

Eğitim, bireysel düzeyde sosyal, ekonomik ve kültürel yetkinliklerin geliştirilmesinde, toplumsal düzeyde ise eşitliği sağlamada ve ekonomik büyümeyi desteklemede temel bir bileşendir. Bu çalışma, eğitimde bilişim sistemlerine yönelik akademik odaklanma ile eğitim sonuçları arasındaki ilişkiyi inceleyerek Filistin'i bir vaka çalışması olarak ele almaktadır. Ayrıca çalışmada Filistin özelinde yapılmış eğitim çalışmaları detaylı şekilde incelenmektedir. Web of Science (WoS) veri tabanında 'Filistin' ve 'eğitim' anahtar kelimeleri kullanılarak bir veri seti oluşturulmuştur. Vosviewer programı ile ortak yazar analizi, anahtar kelime analizi, ülke atıf analizi, kaynak atıf analizi ve bibliyografik eşleştirme analizlerini içeren bibliyometrik analizler gerçekleştirilmiştir. Ayrıca, PISA matematik puanları ile eğitimde bilişim sistemlerine yönelik akademik çalışmaların sayısı arasındaki ilişki, bivariante analiz kullanılarak incelenmiştir. Sonuçlar, bilişim sistemlerine odaklanma ile eğitim başarısı arasında anlamlı ve pozitif bir ilişki olduğunu göstermektedir. Bu durum, eğitimde bilişim sistemlerine öncelik veren ülkelerin PISA değerlendirmelerinde daha yüksek performans sergilediğini ortaya koymaktadır. Çalışmanın sonunda, Filistin'de eğitimde bilişim sistemlerinin rolünü geliştirmek ve ekonomik katkılarını artırmak için öneriler sunulmuştur.

Anahtar Kelimeler

Filistin'de Eğitim
Bilişim Sistemleri
Eğitim Pazarlaması
PISA Puanları
Eğitimde Dijital Dönüşüm

Makale Hakkında

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INTRODUCTION

Education plays a vital role in social, economic, and cultural development. As a phenomenon that concerns not only individuals but also different areas of development in societies, it is examined from different angles in the literature. This study examines the relationship between the use of information systems in education and educational achievement and examines the impact of information systems on educational achievement, focusing on research on the current educational structure in Palestine.

The research is based on two primary analyses. The first assesses the extent to which Palestine is represented in education-related academic literature. The second investigates the correlation between integrating information systems into educational processes and student performance, offering solutions to enhance educational outcomes. Given the vital link between educational development and a country's economic strength, social welfare, and overall progress, more research is required to evaluate education systems from various perspectives. This study employs bibliometric analysis to examine education-related studies on Palestine, focusing on contributing countries, authors, and institutions.

National-level studies often highlight the economic and social returns of education. For instance, Kotásková et al. (2018) demonstrated that primary and secondary education levels significantly influence economic growth in India. Similarly, Amaluddin (2020) showed that higher education levels contribute to poverty reduction and economic growth in Indonesia. These studies emphasize the need to understand the current state of education to promote social and economic development. Accordingly, this study aims to provide insights into the educational landscape in Palestine.

Education promotes social responsibility and community involvement. Lodato (2024) emphasizes that educational systems shape social identities and norms, contributing to cohesive societies. Innovative approaches, such as integrating information systems, enhance creative thinking and problem-solving skills, making societies more dynamic. Research shows that quality education positively impacts social welfare, increasing individual happiness and societal peace (Hikmat, 2022).

This study uses OECD PISA mathematics scores to measure educational achievement and the number of academic studies conducted in the country as an indicator of focus on information systems in education. The primary goal is to examine how integrating information systems impacts student performance and inform policymakers about the benefits of digital transformation in education.

Previous studies, such as those by Förster et al. (2016), have explored the relationship between vocational education and employment, while Adnyana (2023) has highlighted the importance of environmental sustainability in education. These works demonstrate the critical role of national bibliometric studies in understanding the economic and social impacts of education systems and in guiding the development of sustainable educational policies.

1. Conceptual Framework

1.1. Current State of Education in Palestine

The literature highlights both the advantages and limitations of the educational system in Palestine. Abukhattab et al. (2022) emphasize that higher education in Palestine offers numerous opportunities. Adopting an integrated approach in the health sector could significantly enhance educational opportunities (p. 11). Similarly, Qahman et al. (2023) argue that the development and widespread adoption of AI-assisted adaptive e-learning environments in Palestinian schools could overcome the limitations of traditional education methods, providing a crucial opportunity for educational advancement (p. 3987).

Conversely, several studies discuss the limitations of the educational environment in Palestine. These include limited financial resources and inadequate infrastructure, which negatively affect the quality of education. Abuzerr et al. (2021) highlight the absence of the 'One Health' approach in the curriculum and the lack of resources as critical challenges (p. 3). This approach underscores the importance of considering health issues within an ecosystem and fostering interaction with the environment. Meo et al. (2019) point out that the Palestinian education system faces significant challenges due to occupation and political conflicts, ranking lower compared to other Asian countries (p. 1478). While Palestine appears in global rankings based on OECD reports, systemic shortcomings, and adverse regional conditions limit its potential. Further, Qassrawi and Al-Ramahi (2024) explore how the use of Hebrew as the language of instruction in Jerusalem creates integration challenges for Palestinian students, threatening their cultural identity (pp. 13-14).

1.2. The Effects of Educational Activities on Economic and Social Development

Global studies consistently emphasize the economic and social benefits of education. Aghoozi (2020) highlights education as a critical factor for professional and societal development, showing that high-quality education fosters individual growth and contributes to social progress (pp. 1-6). Similarly, Skevington (2009) demonstrates that higher education levels improve quality of life (p. 1003). Other research links improvements in education quality to societal development (Buchanan, 2020, pp. 523-540), better healthcare services (Doughty, 2000, pp. 66-68), increased environmental awareness (Zafar et al., 2020, pp. 1-11), and enhanced social cohesion and interpersonal skills (Flores and Schissel, 2014, pp. 454-479).

In recent years, technological advancements have significantly transformed educational practices. Digitalization in education enhances teachers' knowledge and skills (Belovitskaya et al., 2021, p. 2). Cabero-Almenara and Palacios-Rodríguez (2021) underline the potential of digital technologies to increase inclusivity in education, particularly for students with diverse functional abilities (p. 169). Similarly, Tiwow (2023) emphasizes the importance of human resource management in the digital transformation of universities, noting that improved digital skills enhance institutional flexibility (p. 111). Habib et al. (2020) further highlight that transitioning to interactive educational processes via digital platforms significantly improves accessibility (p. 25).

1.3. Use of Information Systems in Educational Activities and Economic Impacts

The role of information systems in education has become increasingly prominent. These systems accelerate knowledge management and simplify access to educational resources. Under the Education 4.0 framework, information systems make learning processes more interactive and personalized, enriching students' learning experiences (Aktürk, 2020; Öztemel, 2018). They also facilitate expanding distance learning, breaking geographical barriers, and reaching a broader audience (Aktürk, 2020). Additionally, relational and non-relational database systems optimize data management in education, enabling institutions to monitor better student performance (Öztürk and Atmaca, 2017; Henkoğlu and Şerefoğlu, 2019).

Information systems also enhance collaboration and communication in education, fostering more effective interactions between instructors and students (Macit, 2023). However, their implementation is not without challenges. Data security and privacy remain significant concerns for educational institutions (Turan and Kaya, 2017). Moreover, the complexity of these systems can create an additional learning burden for both instructors and students, making them difficult to use effectively (Yılmaz et al., 2021).

Information systems' quality and effective use in education are key factors influencing outcomes and success. Zamir (2023) demonstrates that high-quality information systems enhance students' learning, adaptation, and satisfaction, thereby boosting educational performance. Research on virtual learning environments further suggests that such systems can be more efficient than traditional classrooms (Piccoli et al., 2001). Additionally, studies highlight the direct impact of information systems on student satisfaction and learning outcomes (Eom et al., 2006; Malik et al., 2021).

2. Research Method and Purpose

The study of education systems plays a crucial role in countries' social, cultural, and individual development. Comprehensive analyses of these systems and multidimensional evaluations of existing studies are believed to improve education systems significantly. Findings regarding the current state of education are invaluable for promoting social progress and enhancing economic development. This study aims to evaluate the extent to which research conducted in Palestine focuses on educational issues, analyze the relationship and distribution of existing publications on these topics, and explore the impact of emphasizing information systems in education. This factor can influence educational success.

On October 13, 2024, a search was conducted using the Web of Science (WoS) database at Bursa Uludag University. Publications containing the term 'Palestine' in their titles and 'education' in their keywords and abstract sections were identified, resulting in 1805 publications. Analysis of publication years revealed that the earliest study was published in 1980 and the most recent in 2024. The dataset comprises 1610 articles, 93 conference proceedings, 69 early access studies, 62 book chapters, 39 book reviews, and 35 review articles from various disciplines. The five fields with the highest number of publications were distributed as follows: Education and Educational Research (457), Environmental Public Health (123), Social Sciences Interdisciplinary (98), Sociology (97), and Social Psychology (89).

VOSviewer was used to map academic publications on the relationship between information systems and education, highlighting trends and key research areas in the literature. SPSS was applied to perform statistical analyses, examining the relationship between OECD PISA mathematics scores and the emphasis on information systems, and to determine the significance of this correlation. In this study, the dataset retrieved from the WoS database was subjected to various analyses using the Vosviewer software, including co-author analysis, keyword analysis, country citation analysis, author citation analysis, source citation analysis, bibliographic coupling analysis, and co-citation analysis. The resulting maps were interpreted in the context of the relevant fields. Vosviewer is particularly beneficial for identifying patterns and relationships in bibliometric data, enabling a comprehensive understanding of how education research is interconnected across various domains.

Additionally, bivariate analysis was employed following bibliometric analyses to examine the interaction between the emphasis on information systems in education and educational achievement. For the bivariate analysis conducted using SPSS v.21, PISA mathematics results obtained from OECD reports and the dataset extracted from WoS were utilized. The dataset includes studies categorized under education and information systems. SPSS was chosen for its robust statistical analysis capabilities, while Vosviewer was selected for its efficiency in bibliometric mapping. Combining these tools ensures both statistical accuracy and visual interpretation of data.

The primary research question addressed in this study is whether there is a relationship between OECD PISA mathematics results and studies on information systems in education. This relationship is crucial for understanding how investments in digital transformation within education impact student performance. The research hypotheses are as follows:

H0: There is no significant relationship between these two variables.

H1: There is a positive relationship between these two variables.

3. Findings of Research

3.1. Co-Author Analysis

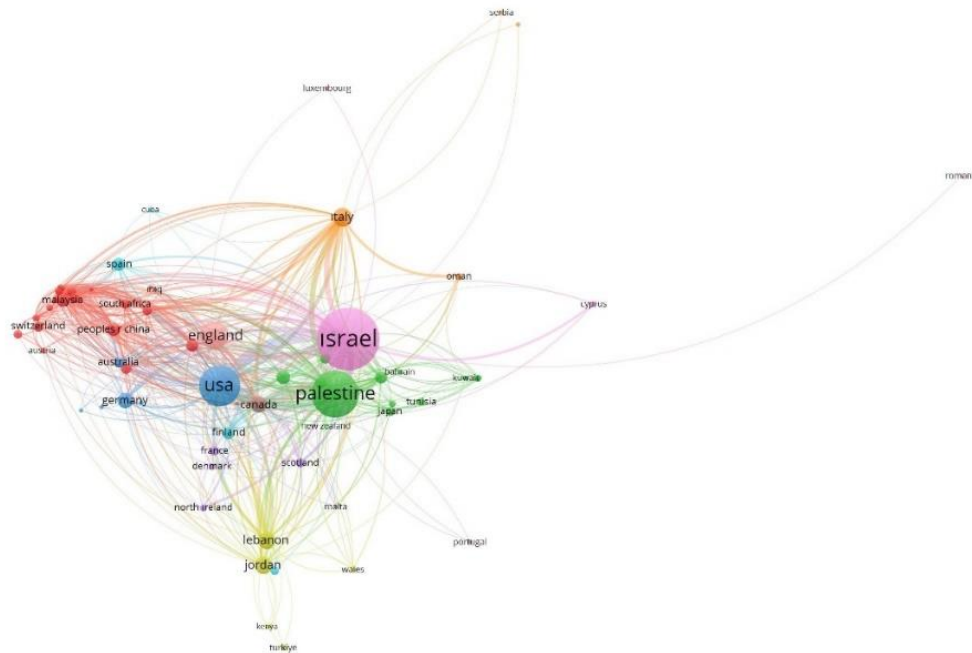
The co-author analysis aims to identify interconnected authors who have collaborated on publications. This analysis can be conducted under various constraints; in this study, authors with at least one publication and one citation were included, as the number of works was sufficient for analysis. Initially, there were 3550 authors in the dataset, but this number was reduced to 2830 after applying the citation threshold. To generate a meaningful map, Vosviewer analyzed 1000 of these 2830 authors.

The co-author analysis identified 242 authors distributed across 20 clusters, with 970 connections observed between them. The total connection strength for these authors within the 20 clusters was 1573. In terms of citations, the most frequently cited authors were Awwad, E (1351 citations), followed by Ali, R (1261 citations), and Babor, TF (1261 citations). However, none of these highly cited authors were among the most connected. Regarding publication volume, Veronese and Guido authored 39 studies, Bar-tal and Daniel produced 32 studies, and Bekerman and Zvi published 26 studies. Among these, only Veronese and Guido were identified as highly connected authors.

3.3. Publication Citation Analysis

In the country citation analysis, which maps the connections between countries based on their publications and citations, a restriction was applied whereby each country must have produced at least one publication and received at least one citation. A total of 81 countries were included in this analysis. The results identified 11 clusters, 720 connections, and a total link strength of 4192 between these 81 interconnected countries. The countries with the most citations were Israel with 13523 citations, the United States with 7300 citations, and Palestine with 3488 citations. Regarding publication output, Israel ranked first with 753 publications, followed by Palestine with 422 publications, and the United States in third place with 327 publications.

Figure 3. Country Citation Analysis Results



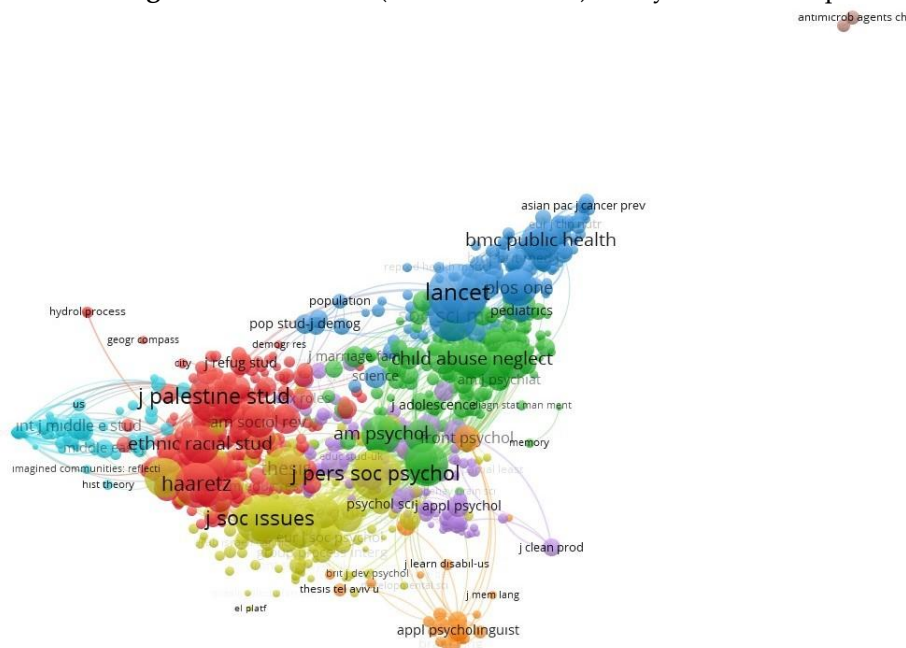
3.4. Source Citation Analysis

In the citation network analysis, sources with at least one publication and at least one citation were selected to generate the citation map. When performing the author citation analysis, 479 connected sources were analyzed. The results revealed 38 clusters, 1467 connections, and a link strength 1856. The most frequently cited source was the Journal of Peace Education with 25 publications, Peace and Conflict: Journal of Peace Psychology with 21 publications, and The Lancet with 20 publications.

3.6. Co-Citation Analysis (On Source)

The analysis of the common citations in different sources cited in a publication is called co-citation analysis. A total of 15 clusters, 85546 links, and 8248 total link strengths were identified according to the analysis performed by reducing 2551 sources to 1000 by Vosviewer by selecting at least five citations, which is shown in the co-citation analysis map. Lancet (501), Journal of Palestine Studies (390), and Journal of Personality and Social Psychology (358) were identified as the most frequently co-cited sources.

Figure 6. Co-Citation (Based on Source) Analysis Result Map



3.7. The Relationship between the Number of Studies on Information Systems in Education and Pisa Mathematics Achievement Results

In order to create Table 1, firstly, the countries with the highest and lowest scores were identified from the rankings in the OECD PISA report, and their achievement scores were written in the relevant field. Then, information about the studies produced by searching for education and information systems in the Title field in the WoS database was obtained. From this information, the number of studies produced based on countries was transferred to the relevant field of the table. In the table, the result of Palestine is highlighted.

Table 1. PISA mathematics results and the number of studies conducted in the country

Country	PISA Math Result	Education Works
Singapore	575	303
Macau	552	4879
Taiwan	547	916
Hong Kong	540	4879
Japan	536	1004
South Korea	527	732
Switzerland	508	451

Table 1 (Continued). PISA mathematics results and the number of studies conducted in the country

Country	PISA Math Result	Education Works
Canada	497	1788
Netherlands	493	812
Ireland	492	317
Belgium	489	328
Denmark	489	298
United Kingdom	489	2510
Poland	489	554
Australia	487	2259
Austria	487	288
Czech Republic	487	507
Slovenia	485	174
Finland	484	491
Saudi Arabia	389	728
Costa Rica	385	86
Colombia	383	399
Argentina	378	191
Jamaica	377	21
Albania	368	24
Palestinian Authority	366	29
Morocco	365	134
Uzbekistan	364	38
Jordan	361	170
Panama	357	18
Kosovo	355	21
Philippines	355	166
Guatemala	344	8
El Salvador	343	4
Dominican Republic	339	17
Paraguay	338	7
Cambodia	336	12

Table 1 transferred to the SPSS v.21 program and subjected to bivariate analysis. The output obtained from the analysis is shown in Figure 7. According to the bivariate analysis results, the correlation coefficient (r) is 0.555, and the p -value is 0.0004. Based on these results, the correlation coefficient shows that there is a positive and moderate relationship between the number of academic studies on information systems in education and PISA mathematics scores. In short, in countries with more research on information systems in education, there is an increase in educational achievement results. This relationship is statistically significant in the result obtained since the p -value is less than 0.05. Hypothesis H_0 is rejected in this case and hypothesis H_1 is supported. It is concluded that there is a significant positive relationship between the number of academic studies on information systems in education and PISA mathematics scores.

Figure 7: Bivariate analysis Result

Correlations		PISAMathResult	EducationWorks
PISAMathResult	Pearson Correlation	1	,508**
	Sig. (2-tailed)		0,001
	N	40	40
EducationWorks	Pearson Correlation	,508**	1
	Sig. (2-tailed)	0,001	
	N	40	40

** Correlation is significant at the 0.01 level (2-tailed).

CONCLUSION

Education is of utmost importance for both individual and national development. Societies that realize this importance and research education from different perspectives gain significant advantages in accelerating economic growth and empowering individuals. Numerous studies, particularly those focusing on education marketing, emphasize that effective marketing strategies in education can improve its quality and generate positive economic outcomes.

The bibliometric analysis of studies on education in Palestine reveals that efforts in this field are satisfactory. However, the literature identifies several obstacles that hinder the development and marketability of educational activities in Palestine. One significant issue is the infrastructural deficiencies in the Palestinian education system. Many educational institutions struggle to access modern technologies and adequate learning materials, which undermines the effectiveness of distance education and limits equal opportunities in education (Ece and Çelik, 2024). Technical issues, particularly in online learning environments, reduce student engagement and overall education quality (Gedik, 2023).

An examination of the literature on Palestinian education shows that a substantial number of studies addressing educational activities in the region are conducted in foreign contexts. Notably, the term 'peace education' frequently appears among the most commonly used keywords, highlighting its potential role in improving educational outcomes. Economic barriers represent another critical challenge. Financial limitations in educational institutions hinder access to high-quality teaching staff and learning resources, directly affecting the quality of education (Akbaş, 2024). Additionally, economic instability reduces families' ability to cover educational expenses, lowering the demand for educational services (Taş, 2023).

Another key finding of the study is the positive correlation between research intensity on information systems in education and educational success. Countries that invest more in research on educational information technologies achieve higher levels of academic performance. Information and communication technologies (ICTs) enhance personalized learning experiences. AI-supported platforms, for example, analyze students' learning styles and provide tailored feedback and content (Thomas, 2024). These technologies contribute to improved educational outcomes by addressing the unique needs of each student (Aslan et al.,

2011). Moreover, educational management information systems (EMIS) are vital for collecting and analyzing educational data, enabling institutions to make informed decisions (Leta, 2024).

This study contributes to the literature by examining the correlation between the focus on information systems, as indicated by academic research, and educational achievement measured by OECD PISA mathematics scores. The findings reveal a significant relationship, emphasizing the potential role of information systems in enhancing educational outcomes. Furthermore, the bibliometric analysis conducted using Vosviewer offers a detailed overview of research on information systems in Palestine. This analysis highlights key trends and gaps in the literature and serves as a valuable resource for future studies seeking to explore similar themes within the context of Palestine or other regions.

This study has certain limitations. One fundamental limitation is the incomplete dataset, as not all countries could be included due to missing data in some OECD reports. This limitation may affect the generalizability of the results. To address this, future research could incorporate data from local Palestinian sources, which may provide more comprehensive insights and allow for a deeper analysis of the educational context in Palestine. Furthermore, the study could be repeated with additional data from non-OECD countries, offering a global perspective on the relationship between information systems and educational success.

From the perspective of societal development and national economic growth, enhancing the education system in Palestine could significantly improve its ability to market value-added educational activities. Despite the substantial body of research on education in Palestine, only a tiny proportion comprehensively addresses the systemic challenges the sector faces. Future studies with larger datasets could provide valuable insights into improving both the marketability of educational activities and the overall educational achievement in Palestine.

Research and Publication Ethics Statement

In this study, I declare that we have obtained the data, information, and documents presented in it in accordance with academic and ethical standards. I have adhered to all scientific ethical and moral rules in presenting all information, documents, evaluations, and results. I have appropriately cited all the work used in the study, and we have not made any changes to the data used. I affirm that the study is original. In case of any contrary situation, I acknowledge to accept all potential rights losses that may arise.

Contribution Rates of Authors to the Article

A single author created this work. All parts of the article are the author's decision and writing.

Ethics Committee Approval

Approval of the ethics committee is not required for this article. The wet signed consent form stating that an ethics committee decision is not required is available in the article process files on the system.

Declaration of Interest

Since the study was single-authored, there was no conflict of interest during the literature review and preparation.

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