Knowledge Mapping of Digital Leadership and Research Agenda: The Open Knowledge Maps Perspective

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Abstract

In today's technological era, digital leadership is necessary for organizational success in facing environmental and technological alteration. This study aims to map digital leadership research using the Open Knowledge Maps platform to find and build cluster visualizations. Moreover, using Open Knowledge Maps as a research analysis tool is rare. The data used is a research paper from 2015 to 2024 with high metadata quality. This study found 15 clusters related to digital leadership, and most research on digital leadership is carried out in the education field. In addition, this digital leadership study also searches for its effect on employee performance. This study implies that it can find research gaps that can be helpful for future research as the basis for further research.

Keywords: Cluster, Digital Leadership, Open Knowledge Maps, Employee Performance, Research Trend

1. Introduction

The presence of the digital era originating from technological developments leads to economic and social changes in the world community [1]. Digital transformation dramatically affects the performance of any organization nowadays [2]. Today, most organizational leaders' faces differ from past technical problems [3]. Thus, traditional leadership is no longer enough for an organization's progress.

Thus, digital transformation requires leaders with the knowledge and experience to drive technology utilization and integration to realize organizational success [4]. Therefore, leadership is essential in adopting digital technology in an uncertain and complex environment [3]. Thus, leaders in this digital era must employ and keep up with technological developments.

Avolio et al. [5] coined the term digital leadership as e-leadership. Based on their study, the work process in an organization in the digital era can be carried out by employing information technology, especially the Internet. Moreover, a leader could make information in an organization more accessible through electronic media. Meanwhile, Zeike et al. [6] explained that digital leadership is not only using email, social media, and websites in working but also using data as a digital asset, which is more important. Hence, digital leadership is a leadership style that employs information technology to achieve organizational goals. In brief, Digital leadership combines leadership style and utilizing technology [7].

Fisk [8] conveyed that digital leadership is not merely utilizing technology but also creating new connections and value for the organization in new ways. Therefore, digital leadership also remains to have a vision and can motivate the subordinate. Indeed, by employing technology, a leader could expand his influence [9]. Digital leadership become necessary for developing organizations from various sectors [10], [11]. Succinctly, digital leadership is the ability of a leader to employ technology and utilize data as data-driven decision-making to achieve corporate goals and improve employee performance.

As a new relative leadership style, digital leadership faces many challenges, including many organizations that are not fully ready to face digital transformation, such as many works must be resolved through technology and the low ability

of employees to utilize digital technology at work [12]. Digital leadership is also described as a leadership style that comprehends the business or organization, has favorable communication skills, and master's digital technology to direct employees through digital tools [13]. In summary, digital leadership is a leader's ability to use technology and data to carry out his leadership activities and make decisions.

Even the rapid change and development of technology raise uncertainty in the organization [14]. Nowadays, leaders also encounter information overload from various sources [15]. All these problems require top management to adapt technology while redesigning business models and corporate strategy in today's modern organizations [16]. It demands digital leadership to deal with all the challenges.

Technological advances have developed research methods such as bibliometric analysis, scientometrics, and literature reviews. Meanwhile, research trends are a form of activity carried out by researchers individually or in a group to find specific themes or topics. It can be done by reviewing literature or bibliometric analysis [17]. Research trends are also carried out by examining specific academic themes and setting a certain period [18]. Most digital leadership research trends and literature reviews are analyzed using bibliometric methods [19], [20] or literature reviews [21], [21], [23]. However, using Open Knowledge Maps for digital leadership research has yet to be implemented. It is also a differentiation from prior research and a novelty for this study.

The purpose of the Open Knowledge Map is to create visual connections of scientific knowledge worldwide. Knowledge maps display the main areas of the research in a circle, as well as documents related to each cluster. Each similar area is positioned closer to each other than a different subject, so grouping articles makes it easier to examine [24], [25].

Previous Open Knowledge Maps research platforms have been applied to various fields, such as supply chain [26], blockchain technology [27], and organizational agility [28]. Open Knowledge Maps is a platform that visually presents relevant research search results accompanied by relationships between literature. The basis of this visual interface is called knowledge maps, which allow for knowledge exploration. In addition, Open Knowledge Maps intend to increase the discovery of scientific knowledge based on the principles of open-access science to be able to review published research findings [24].

This study reviews research mapping from previous studies related to digital leadership. The specific purpose of this research is to analyze research trends in digital leadership and discover cluster mapping of digital leadership research topics so that it can form state-of-the-art research on digital leadership to find research opportunities for future research. Therefore, researchers propose research questions (RQ) for this study: (RQ1) What are the most researched clusters concerning digital leadership? (RQ2) How digital leadership research trends in the perspective of Open Knowledge Maps; (RQ3) How is the effect of digital leadership in improving performance; and (RQ4) What is the future research that can be developed regarding digital leadership?

2. Literature Review

This article was conducted by searching literature through data visualization from the Open Knowledge Maps platform. Open Knowledge Maps is an open-source tool for visually mapping scientific knowledge. Open knowledge maps allow users to construct concept maps and make connections between subject matter [24]. In this study, Open Knowledge Maps are intended to analyze and explain clusters in digital leadership.

The documents released by Open Knowledge Maps result from the Bielefeld Academic Search Engine (BASE) database. BASE indexing metadata from various academic sources. One of the advantages of BASE is that the documents produced are Open Access documents [25]. Open-access documents facilitate the analysis process because we can analyze the documents in detail. Another case with closed-access documents can only be seen in the abstract.

The parameters used in searching articles begin with determining keywords, namely "digital leadership." Double quotation marks (") aim to get digital leadership keywords that are not separated. Furthermore, the data type sought is only journal articles from research results between 2015 and 2024. At the same time, the kind of metadata sought is high metadata quality. Furthermore, the articles are all in different languages to provide more comprehensive information. Some of the papers use German; thus, the author translates them first into English to analyze them.

Meanwhile, the documents are only research articles and conference proceedings, while ebooks and book chapters are excluded.

The similarity is examined based on the articles obtained, supposing there was the same article, and only one was selected. All selected articles were analyzed to map digital leadership research trends per the research questions set. Another tool used is Microsoft Excel, which illustrates graphs to show article trends per year. In addition, Connected Papers are also used as a complement to find out the network formed from an article that is most cited. The papers are adequate for further analysis and are related to the discussed topic. This study analyzes, reviews, and explains each factor from the perspective of previous literature.

3. Method

Open Knowledge Maps generated 100 articles concerned with digital leadership. Then, an initial examination of duplicate articles and two duplicate papers were found. Thus, the number of articles analyzed was 98 papers, an overview of digital leadership research trends generated by Open Knowledge Maps depicted in figure 1.

Figure 1. Overview of Research on Digital Leadership

Source: Open Knowledge Maps [29]

Furthermore, the results of mapping visualization obtained by Open Knowledge Maps are used as a foundation for answering research questions.

3.1. What Are the Most Researched Clusters Concerning Digital Leadership?

The keyword "digital leadership" search results are grouped into 15 clusters. Each cluster indicates a research theme employed as a source for mapping analysis of digital leadership research. The distribution of clusters and the number of articles contained in each cluster are shown in table 1.

Table 1. Open Knowledge Maps cluster data tabulation

Cluster	Items	Source
Cluster-1	Digital transformations, Digital liderlik, Cloud-based accounting	14
Cluster-2	Digital educational resources, With performance, Digital Awareness	14
Cluster-3	Organizational behavior and human resource management, Project management, Psychological wellbeing	10
Cluster-4	Dijital liderlik ölçeği, Learning organization, Digital Transformation, Digital leadership, Individual performance	9
Cluster-5	Artificial intelligence, Digital disruptive, Exploratory innovation	9

Cluster-6	Job satisfaction, Employee performance, Digital competency	8
Cluster-7	Public school principals, Technology capabilities, Challenges	7
Cluster-8	Digital circle, Expert Circle, Veränderten Arbeitswelten	6
Cluster-9	Digital leadership in, A bibliometric analysis, Bibliometric analysis	4
Cluster-10	South Korea, Environmental effects of industries and plants, Environmental sciences	4
Cluster-11	Customer experience orientation, Market orientation, Business model innovation	4
Cluster-12	University of Tabuk, Performance evidence, Social science	3
Cluster-13	Knowledge management, Competitive advantage, Industrial	2
Cluster-14	Balance scorecard, Non-financial performance, Startup companies	2
Cluster-15	5-theory and practice of education, Digital maturity framework, Educational technology	2

Source: Author, based on Open Knowledge Maps

The most significant clusters are "Digital transformations, Digital liderlik, Cloud-based accounting" and "Digital educational resources, with performance, Digital awareness" comprising 14 articles. The most significant clusters do not intersect directly but are connected by the "Organizational behavior and human resource management, Project management, Psychological wellbeing" cluster.

The elucidation of each cluster shows that cluster-1 is about the relationship between digital leadership and digital transformation and its impact on organizational performance. In this cluster, there is an article about digital leadership and performance. However, the article still explains its connection to digital transformation. Furthermore, cluster-2, cluster-7, and cluster-12 generally consist of articles on digital leadership for education. The dissimilarity of each cluster is that cluster-2 focuses on the school environment and teachers utilizing technology as a learning tool, including perceived technology by teachers. Meanwhile, cluster-7 contains the practice of digital leadership by the principal and its correlation to teacher performance, in contrast to cluster-7, which discusses explicitly digital leadership in higher education.
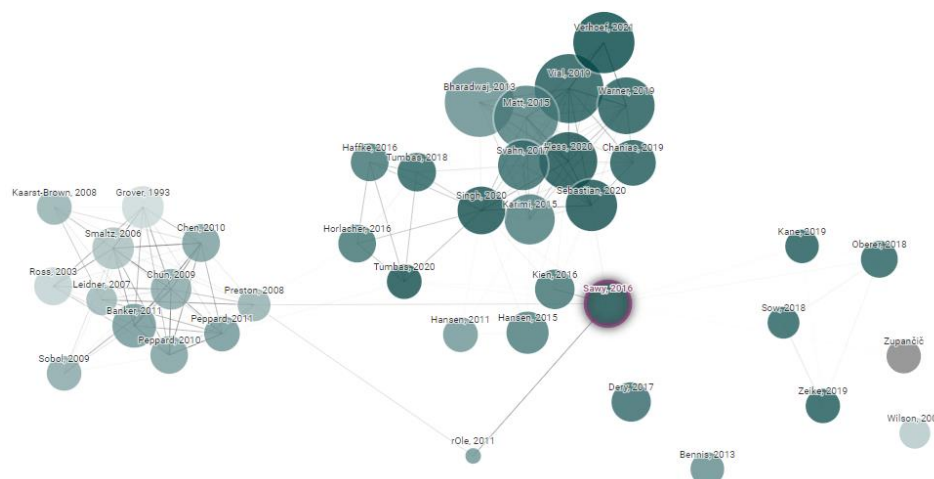
Cluster-3 and cluster-9 accommodate many articles that discuss bibliometric analysis. However, some articles in cluster-3 also examine human resources. Cluster-9 consists of all papers that include bibliometric analysis of digital leadership. Meanwhile, cluster-4 reviews how to develop a digital leadership scale. Büyükbeşe et al. [30] elucidated those studies on the assessment process for digital leadership are inadequate. Several papers will be collected in this cluster that explain the digital leadership scale developing process with reliability and validity. In addition, three articles discuss the correlation between digital leadership and individual performance in this cluster.

On the contrary, cluster-5 discusses how digital leadership relates to organizational and business performance. Apart from this, there is an article that reviews employee job performance. The same cluster discussing organizational performance is cluster-14. This cluster only contains a startup company as an analysis unit. Digital leadership investigation in this cluster is viewed from the Balanced Scorecard perspective so that it sees the consequences on company performance both in financial and non-financial terms. Hence, it is slightly different for cluster-6, which consists of eight articles; 4 papers dissect the relationship between digital leadership and job satisfaction, and four articles discuss the relevance of digital leadership to employee performance. Moreover, cluster 8 contains articles describing the strategy for implementing digital leadership in organizations.

Cluster-10 enthaltend four papers that discuss how to apply digital leadership in various organizations. Interestingly, all the articles in the cluster conducted research in South Korea. Furthermore, all articles within cluster-11 examine how digital leadership drives innovation in business organizations. Specifically, the innovation of the business model is divided into customer experience research and market orientation. Unlike cluster-13, all articles in the group discuss the relationship of digital leadership to total quality management and its roles in increasing competitive advantage. In the last one, cluster-15, all papers in the cluster are Systematic Literature Reviews and framework articles on digital leadership.

When viewed partially, cluster-1 (Digital transformations, Digital liderlik, Cloud-based accounting) intersects directly with cluster-10, cluster-3, cluster-8, and cluster-9. Whereas, cluster-2 (digital educational resources, with performance, Digital awareness) intersects directly with cluster-6, cluster-12, cluster-15, cluster-7, and cluster-3.

Of the 98 papers analyzed, the journal that published the most digital leadership topics was the Sustainability journal, which had six papers. Jurnal Sustainability itself is a reputable international journal with the Q1 category. The most prolific writer who has published digital leadership articles is Leonardus W Wasono, who has written four papers.

Furthermore, from the number of citations, the most cited article is "How LEGO Built the Foundations and Enterprise Capabilities for Digital Leadership" by Sawy et al. [16]. The article has been cited 487 times. If the article is viewed more deeply using Connected Papers, it acts as an article that connects two research groups. Further, the network formed between the paper "How LEGO Built the Foundations and Enterprise Capabilities for Digital Leadership" and other documents is directly related to nine other articles, which are Preston et al. [63], Thatcher et al. [64], Sia et al. [65], Singh and Hess [66], Oberer and Erkollar [67], Sow and Aborbie [68], Kane et al. [69], Hess et al. [70], and Sebastian et al. [71]. An overview of the network formed is depicted in Figure 2.

Figure 2. Overview of Sawy et al. [16] Research

Source: Connected Papers [72]

The Open Knowledge Maps output shows the role of digital leadership is not only to accelerate digital transformation in organizations. However, it is also a leadership style that has to be applied in the Industrial Revolution 4.0 era, particularly with the rapid technology development, which demands a leader capable of assimilating with the updated technology. In addition, digital leadership practice is still limited to enterprise organizations. Small organizations such as SMEs must also be encouraged to implement digital leadership.

3.2. How Are Digital Leadership Research Trends from the Perspective of Open Knowledge Maps?

When viewed from the development of research on digital leadership, it continues to increase. It is known from articles produced by Open Knowledge Maps that there is an increasing number of papers about digital leadership every year. Although in 2017, Open Knowledge Maps did not find articles about digital leadership, the growth of research papers on digital leadership has increased. Figure 3 depicts the publication trend of Digital Leadership research.
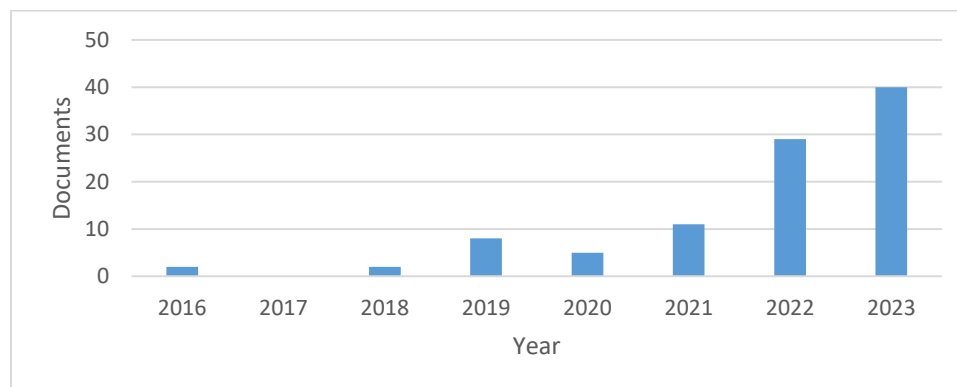

Figure 3. Digital leadership documents by years

Source: Author

The first article recorded in Open Knowledge Maps related to digital leadership is "Digital Leadership," published in 2016 by Tadeja Zupancic, Johan Verbeke, Henri Achten, and Aulikki Herneoja. Based on the results of Open Knowledge Maps visualization, it can be explored that for the last seven years, research on the digital leadership topic has been reviewed from the perspective of Digital transformations, Digital educational, performance, and Digital awareness.

Furthermore, most of the digital leadership studies focus on the education field. It could be seen from cluster-2 as one of the most significant clusters in mapping analysis presented by Open Knowledge Maps. It is supported by cluster-7, which has a sub-theme of digital leadership in schools, and cluster-12, which has a sub-theme of digital leadership in universities. The previous studies that agglomerate in cluster-2 discuss the role of digital leadership in education, such as digital leadership implementation at universities [31], [32], [33], primary education, including early childhood education [34], [35], and research on the impact of digital leadership to teacher performance [36], [37], [38], [39], [40].

Next, cluster-7 (Public school principals, Technology capabilities, Challenges) contains articles discussing the relationship between digital leadership to principals and teachers as an analysis unit. Likewise, all articles in cluster-12 (University of Tabuk, performance evidence, social science) consist of papers that specifically discuss digital leadership in the university environment.

Despite educational papers, digital leadership topics are also widely discussed in business objects or private companies, which are contained in several clusters. Judging from the organization's object, it consists of telecommunications enterprises, IT companies, Startups, manufacturing, and automotive industries. Meanwhile, for the health sector, there are four articles and three articles examining digital leadership in the banking industry. Likewise, with research in the public service field, only three articles discuss it. Otherwise, some organizations are rarely studied, i.e., tourism organizations, SMEs, and real estate.

The accretion of digital leadership papers continues to grow, which means that the digital leadership topic is a fascinating research trend to be studied. Particularly since 2022, articles have significantly increased due to the Covid-19 outbreak; many countries implemented lockdowns. Therefore, many activities can be done remotely, requiring the ability to utilize technology. Digital leadership has become prominent because it covers various fields, such as technology, data, management, business, education, and leadership.

3.3. What is the Effect of Digital Leadership in Improving Employee Performance?

Concerning digital leadership and employee performance, it shows that the study of digital leadership is generally associated with the performance of teachers, principals, or college leaders. It is also the trend of digital leadership research that is widely applied to the education field. There are several digital leadership researches in the education sector because, since COVID-19, educational institutions have been forced to adapt to digital systems. Therefore, leaders who can empower technology, not just traditional leadership, are needed.

The implementation of digital leadership for business and public organizations is in cluster-1. The discussion contained in the cluster is divided into digital transformation [41], [42], [43], [44], [45], [46], [47], [48], the correlation of digital leadership to performance [49], [50], a digital leadership framework for organizations [51], [52], and an overview of the concept of digital leadership [53], [54].

Differing from cluster-5 (Artificial intelligence, Digital disruptive, Exploratory innovation), it analyzes the relationship of digital leadership to organizational performance. It does not examine the impact on individual employee performance, so it is not grouped into employee performance clusters.

In addition, previous studies that discuss the influence of digital leadership on employee performance are found in eight papers. Three papers are in cluster-6 and cluster-4, one in cluster-1, and one in cluster-5. The difference between the papers in cluster-6 and cluster-4 is the research object. Cluster-6 mentions employee performance, but cluster-4 uses the term individual performance. Meanwhile, employee performance articles in cluster-1 and cluster-5 use the term job performance.

Three papers examined bank employees based on the eight articles discussing digital leadership relationships [55], [56]. Artüz and Bayraktar [56] studied bank employees in Turkey, both private and state-owned banks, with a sample of 193 respondents and analyzed using multiple linear regression. The results found a significant favorable influence of digital leadership on bank employee performance. Hidayat et al. [55] also examined BPR bank employees in Indonesia with 104 respondents, then analyzed using Structural Equation Modeling. The findings of this study stated that digital leadership has a significant positive effect on employee performance and job satisfaction. Based on prior research, employees perceive the enhancement of digital leadership as improving employee performance. Moreover, Sulistiana and Darma [35] appended that digital leadership is essential in increasing employee engagement.

Four studies were conducted on private companies [57], [58], [59], [60]. Abbasov [57] viewed digital leadership as a leadership style crucial in the Industrial Revolution 4.0 era. Various companies in Azerbaijan found that digital leadership can improve the individual performance of employees by 59%. The main factor that affects the performance is leaders' ability to employ various information technology platforms. Furthermore, Mohamed [58] examined the correlation of digital leadership on employee performance and work motivation of millennial employees in Cairo. Using SEM-PLS to evaluate the effect of these variables, it was found that digital leadership positively impacts employee performance and work motivation.

In addition, digital leadership can improve employee performance and positively impact innovation behavior and intention to engage in intrapreneurship. This study shows that digital leadership fosters innovation in an organization. This finding was discovered by Sagbas, who delved into IT sector employees in Istanbul [59]. Despite providing a direct effect of digital leadership on employee performance, digital leadership can also act as a moderation variable. In this case, digital leadership can reduce social loafing, and as a consequence, it will increase job performance [60].

Digital leadership's importance in improving employee performance can also be applied in hospitals. Allfares' research, which was analyzed using the linear regression method, emphasizes that it is crucial to strengthen digital leadership elements to have a practical impact [61]. Digital leadership's role in improving employee performance could also be applied to SMEs [62]. The prior study shows that digital leadership enhances employee performance in many sectors, such as education, banks, private organizations, hospitals, and SMEs.

The findings of prior research show that digital leadership is essential for improving employee performance. Especially in today's technological era, all organizations have led to digital transformation. Technological developments such as AI, big data, social media, and the Internet of Things are also increasing. Therefore, employees must be trained in digital skills.

3.4. What Future Research Can Be Developed Regarding Digital Leadership?

According to the eight articles that discuss the relationship between digital leadership and employee performance, no one paper analyzed the role of digital leadership in improving employee performance in government and non-profit organizations. Thus, based on the analysis of Open Knowledge Maps, the discussion of digital leadership related to employee performance in public organizations, such as civil servants, still needs to be analyzed. In addition, with SMEs as the object of the research analysis unit, only one paper discusses the role of digital leadership for SMEs.

The discussion about digital leadership in public organizations is found in two articles. Both articles discuss the substantial transformation of digital leadership toward digital transformation to develop a positive alteration in public organizations, such as efficiency, transparency, and public participation [52] to improve organizational performance [45]. However, neither article discusses digital leadership's relationship to employee performance in the public service sector.

Through the above analysis, we can infer that digital leadership still has many opportunities in the research domain, especially concerning employee performance. Moreover, judging from the existing clusters, the digital leadership topic can still develop with more varied subtopics. One of them is the application of digital leadership for non-profit organizations and SMEs.

Many variables can be explored in searching for the role of digital leadership in innovation. In addition, digital leadership can also function as both a mediation and moderation variable. Digital leadership is one of the variables

rarely used. Digital leadership has great opportunities in research. Future research can explore the antecedent and consequence variables related to digital leadership.

4. Conclusion

Refers to the results of Open Knowledge Maps visual mapping, there are 15 research clusters in digital leadership. The largest clusters are "Digital transformations, Digital liderlik, Cloud-based accounting" and clusters "Digital educational resources, With performance, Digital awareness." Meanwhile, research on digital leadership is widely applied to the field of education, which is contained in three clusters.

The findings also show that digital leadership has a role in improving employee performance. Digital leadership as a research topic increases every year. The study of digital leadership is an exciting area to investigate further. Every year, the increasing number of digital leadership papers shows that the research topic will keep growing, and there are more opportunities for researchers to find other sub-topics that can be explored. It also shows that studies related to digital leadership are still being extensively developed.

Based on the analysis, many future research opportunities related to digital leadership can be conducted. There is little study on SMEs, government, and non-profit organizations from the research object. Meanwhile, several variables can be investigated further for the consequent variables of digital leadership, for example, the relationship between digital leadership and innovation, organizational inertia, organizational commitment, and financial performance.

However, the limitation of this study is that it investigates digital leadership globally. Scholars can use additional keywords and digital leadership for further research to find more specific results. Future researchers can also analyze the relationship of digital leadership with particular variables. Moreover, for future research, scholars can conduct research mapping analysis using other platforms to compare the findings or confirm the results of Open Knowledge Maps.

The implications of this study show that leaders, including managers or policymakers, must comprehend the technology and determine data-driven decisions. The role of digital leadership is not only to communicate or motivate subordinates remotely. Moreover, digital leadership can contribute to organizational work processes, e.g., Efficiently, transparently, and systematically. Even the reporting process can be conveniently available in a short time.

5. Declarations

5.1. Author Contributions

Conceptualization: E.Z.Z. and S.A.; Methodology: S.A. and J..; Software: J. and E.Z.Z.; Validation: E.Z.Z., S.A., J. and S.R.; Formal Analysis: E.Z.Z., S.A., J. and S.R.; Investigation: E.Z.Z.; Resources: S.A.; Data Curation: S.A. and S.R.; Writing Original Draft Preparation: E.Z.Z. and S.A.; Writing Review and Editing: S.A. S.R. and E.Z.Z.; Visualization: E.Z.Z., J. and S.R.; All authors have read and agreed to the published version of the manuscript.

5.2. Data Availability Statement

The data presented in this study are available on request from the corresponding author.

5.3. Funding

5.4. Institutional Review Board Statement

Not applicable.

5.5. Informed Consent Statement

Not applicable.

5.6. Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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