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Author(s): Tomáš Klieštik, Katarina Zvarikova, George Lăzăroiu

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Data-driven Machine Learning and Neural Network Algorithms in the Retailing Environment: Consumer Engagement, Experience, and Purchase Behaviors

Tomas Kliestik[1], Katarina Zvarikova[2], George Lăzăroiu[3]

ABSTRACT. Based on an in-depth survey of the literature, the purpose of the paper is to explore data-driven machine learning and neural network algorithms in the retailing environment. In this research, previous findings were cumulated showing that customer brand perception and satisfaction can be carried out according to machine learning algorithms and big data, and we contribute to the literature by indicating that user decision-making algorithms throughout the online environment can be pivotal in artificial intelligence technologies to more thoroughly grasp the consumer journey. Throughout January 2022, a quantitative literature review of the Web of Science, Scopus, and ProQuest databases was performed, with search terms including "retail" + "data-driven machine learning," "neural network algorithm," "consumer engagement," "consumer experience," and "purchase behavior." As research published in 2022 was inspected, only 148 articles satisfied the eligibility criteria. By taking out controversial or ambiguous findings (insufficient/irrelevant data), outcomes unsubstantiated by replication, too general material, or studies with nearly identical titles, we selected 22 mainly empirical sources. Reporting quality assessment tool: PRISMA. Methodological quality assessment tools include: AMSTAR, Dedoose, Distiller SR, and SRDR.

JEL codes: D12; D22; D91; L66; E71

Keywords: machine learning; neural network algorithm; retail; consumer; behavior

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[1]Faculty of Operation and Economics of Transport and Communications, Department of Economics, University of Zilina, Zilina, Slovak Republic, tomas.kliestik@fpedas.uniza.sk.
[2]Faculty of Operation and Economics of Transport and Communications, Department of Economics, University of Zilina, Zilina, Slovak Republic, katarina.zvarikova@fpedas.uniza.sk.
[3]The Institute of Smart Big Data Analytics, New York City, NY, USA; Spiru Haret University, Bucharest, Romania, phd_lazaroiu@yahoo.com (corresponding author).

1. Introduction

The purpose of our systematic review is to examine the recently published literature on data-driven machine learning and neural network algorithms in the retailing environment and integrate the insights it configures on consumer engagement, experience, and purchase behaviors. By analyzing the most recent (2022) and significant (Web of Science, Scopus, and ProQuest) sources, our paper has attempted to prove that customer brand perception and satisfaction can be carried out according to machine learning algorithms and big data. The actuality and novelty of this study are articulated by addressing algorithmic shopping decision journeys, that is an emerging topic involving much interest. Our research problem is whether artificial intelligence payment tools may increase willingness to buy quickly or over-purchase, optimizing consumption of goods and services in terms of utility, shaping online consumption pattern behaviors and consumer purchase decisions.

In this review, prior findings have been cumulated indicating that the impact of artificial intelligence-enabled checkouts develops on users' convenience perception. The identified gaps advance user interaction, purchase intention, and consumer behavior across retail business operations. Our main objective is to indicate that user decision-making algorithms throughout the online environment can be pivotal in artificial intelligence technologies to more thoroughly grasp the consumer journey. This systematic review contributes to the literature on predictive analytics, automated decision-making processes, and machine and deep learning techniques (Andronie et al., 2021a, b; Birtus and Lăzăroiu, 2021; Lăzăroiu, 2013; Musova et al., 2021) in retail e-commerce business by clarifying that collaborative data-driven tools can assist in developing employee–customer interaction. This research endeavors to elucidate whether artificial intelligence service is prompt, accommodating, unbiased, considerate, and stress relieving. Our contribution is by integrating research findings indicating that artificial intelligence assistant upsides constitute determinants influencing perceived utilitarian/hedonic value, thus shaping user willingness.

2. Theoretical Overview of the Main Concepts

By use of data gathering and analysis, data-driven retail innovations (Alimamy and Gnoth, 2022; Huang and Rust, 2022; Liao et al., 2022; Rausch et al., 2022; Zhao et al., 2022) can articulate content production, shopping, and interaction. Chatbots are pivotal in digital customer service in terms of purchase intentions through machine learning technologies. Knowledgeable power over artificial intelligence assistants can decrease consumer risk perceptions. Perceived confidence and risk are related to increased customers'

intentions to create together across both web and augmented reality-based shopping. Digital technology and artificial intelligence tools can optimize user engagement, sales performance, shared value creation, distinct purchasing decisions, and customized shopping experiences. Online purchasing intentions, choices, behaviors, patterns, and habits can be configured by machine learning and neural networks. The manuscript is organized as following: theoretical overview (section 2), methodology (section 3), collaborative data-driven tools in web and augmented reality-based shopping (section 4), machine learning and neural networks in retail e-commerce business (section 5), data-driven retail innovations and machine learning technologies in digital customer service (section 6), discussion (section 7), synopsis of the main research outcomes (section 8), conclusions (section 9), limitations, implications, and further directions of research (section 10).

3. Methodology

Throughout January 2022, a quantitative literature review of the Web of Science, Scopus, and ProQuest databases was carried out, with search terms comprising "retail" + "data-driven machine learning," "neural network algorithm," "consumer engagement," "consumer experience," and "purchase behavior." The search terms were determined as being the most employed words or phrases across the analyzed literature. As research published in 2022 was analyzed, only 148 articles met the suitability criteria. By removing questionable or indeterminate findings (insubstantial/inconsequent data), results unconfirmed by replication, too imprecise content, or having quite similar titles, 22, chiefly empirical, sources were selected (Tables 1 and 2). Extracting and inspecting publicly accessible files (scholarly sources) as evidence, before the research began no institutional ethics approval was required. (Figures 1 and 2)

Table 1 Topics and types of scientific products identified and selected.

Topic	**Identified**	**Selected**
retail + data-driven machine learning	32	5
retail + neural network algorithm	28	4
retail + consumer engagement	29	4
retail + consumer experience	28	4
retail + purchase behavior	31	5
Type of paper		
Original research	120	22
Review	7	0
Conference proceedings	11	0
Book	4	0
Editorial	6	0

Source: Processed by the authors. Some topics overlap.

Table 2 General synopsis of evidence as regards focus topics and descriptive outcomes (research findings).

Customer interactions with virtual and augmented reality can result in shopping mall loyalty. Perceived confidence and risk are related to increased customers' intentions to create together.	Alimamy and Gnoth, 2022; Ameen et al., 2022; Rausch et al., 2022
Artificial intelligence customers and service providers can augment or take over human ones as regards purchase decisions.	Huang and Rust, 2022; Liao et al., 2022; Zhao et al., 2022
Algorithmic shopping decision journeys for users can assist retailers in interacting with prospective customers without an intermediary instantaneously. User perceived risk and confidence integrate refashioning and co-creation purposes in web-based shopping.	Alimamy and Gnoth, 2022; Battisti et al., 2022; Rodgers and Nguyen, 2022; Yuan et al., 2022
Predictive analytics, automated decision-making processes, and machine and deep learning techniques can be deployed in user interaction, purchase intention, and consumer behavior across retail business operations.	Ghazwani et al., 2022; Hu et al., 2022; Sharma and Shafiq, 2022; Zhao et al., 2022
Retail e-commerce business harnesses machine learning and neural networks to inspect buyer behavior and engage consumers adequately so as to provide optimized products and value-added services to satisfy their demands, enhancing operational efficiencies.	Shaikh et al., 2022; Xu et al., 2022; Yang et al., 2022
Artificial intelligence technologies can track and grasp consumer decision process and journey. Customer personalization perceptions are related to co-creation intention in web-based shopping.	Alimamy and Gnoth, 2022; Rabassa et al., 2022; Rodgers and Nguyen, 2022
Digital technology and artificial intelligence tools can be harnessed routinely throughout the lifecycle management processing and supervision and quality assurance of products.	Giroux et al., 2022; Hallows et al., 2022; Rodgers and Nguyen, 2022
Machine learning methods are pivotal in defining customer sentiment, empathetic behavioral reactions, and emotional experiences. Artificial intelligence services support customer continuous usage intention and emotional response through multisensory interaction.	Bai, 2022; Hossain and Rahman, 2022; Lv et al., 2022
Data-driven retail innovations can enhance sales performance, customer engagement, and store shopping experience. User decision-making algorithms throughout the online environment can be pivotal in artificial intelligence technologies to more thoroughly grasp the consumer journey.	Battisti et al., 2022; Crolic et al., 2022; Rodgers and Nguyen, 2022

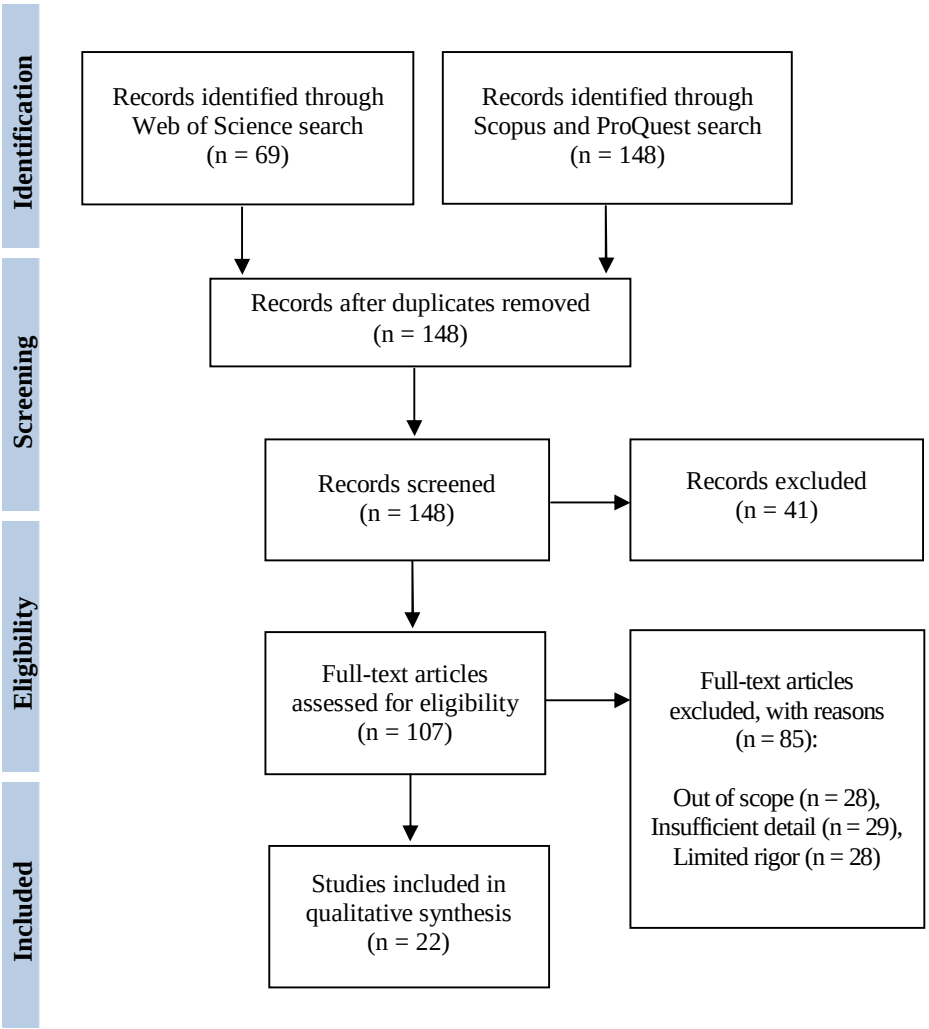

Figure 1 PRISMA flow diagram describing the search results and screening.

Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA) guidelines were used that ensure the literature review is comprehensive, transparent, and replicable. The flow diagram, produced by employing a Shiny app, presents the stream of evidence-based collected and processed data through the various steps of a systematic review, designing the amount of identified, included, and removed records, and the justifications for exclusions.
To ensure compliance with PRISMA guidelines, a citation software was used, and at each stage the inclusion or exclusion of articles was tracked by use of custom spreadsheet. Justification for the removal of ineligible articles was specified during the full-text screening and final selection.

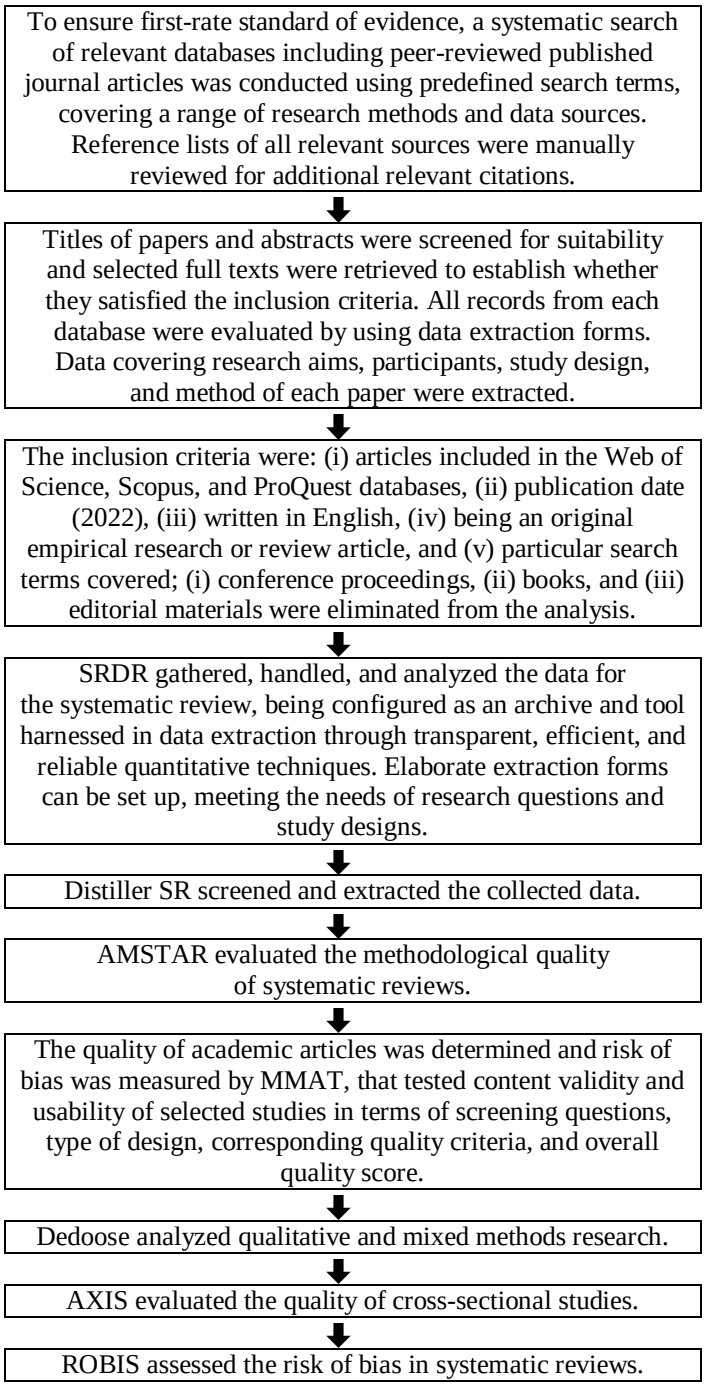

Figure 2 Screening and quality assessment tools

4. Collaborative Data-driven Tools in Web and Augmented Reality-based Shopping

Customer interactions with virtual and augmented reality (Alimamy and Gnoth, 2022; Ameen et al., 2022; Rausch et al., 2022) can result in shopping mall loyalty. The accurate records of previous usage behaviors encompassed by log documents and subsequent clickstream information can be inspected by retailers to gain relevant insights. Perceived confidence and risk are related to increased customers' intentions to create together across both web and augmented reality-based shopping.

Artificial intelligence customers and service providers (Huang and Rust, 2022; Liao et al., 2022; Zhao et al., 2022) can augment or take over human ones as regards purchase decisions. While human customer service is more adjustable and sympathetic than artificial intelligence service, users may be gratified with the latter as its feedback is prompt, accommodating, unbiased, considerate, and stress relieving. Customized recommendation systems can harness consumers' interests and online purchasing intentions, choices, behaviors, patterns, and habits to suggest tailored information and merchandise by use of data gathering and analysis, articulating content production, shopping, and interaction.

Algorithmic shopping decision journeys for users (Alimamy and Gnoth, 2022; Battisti et al., 2022; Rodgers and Nguyen, 2022; Yuan et al., 2022) can assist retailers in interacting with prospective customers without an intermediary instantaneously. Artificial intelligence assistant upsides constitute determinants influencing perceived utilitarian/hedonic value, thus shaping user willingness. Collaborative data-driven tools can assist in developing employee–customer interaction and optimize user engagement, sales performance, shared value creation, distinct purchasing decisions, and customized shopping experiences. User perceived risk and confidence integrate refashioning and co-creation purposes in web-based shopping. (Table 3)

Table 3 Synopsis of evidence as regards focus topics and descriptive outcomes (research findings)

Customer interactions with virtual and augmented reality can result in shopping mall loyalty. Perceived confidence and risk are related to increased customers' intentions to create together.	Alimamy and Gnoth, 2022; Ameen et al., 2022; Rausch et al., 2022
Artificial intelligence customers and service providers can augment or take over human ones as regards purchase decisions.	Huang and Rust, 2022; Liao et al., 2022; Zhao et al., 2022
Algorithmic shopping decision journeys for users can assist retailers in interacting with prospective customers without an intermediary instantaneously.	Alimamy and Gnoth, 2022; Battisti et al., 2022; Rodgers and Nguyen, 2022; Yuan et al., 2022

5. Machine Learning and Neural Networks in Retail E-Commerce Business

Predictive analytics, automated decision-making processes, and machine and deep learning techniques (Ghazwani et al., 2022; Hu et al., 2022; Sharma and Shafiq, 2022) can be deployed in user interaction, purchase intention, and consumer behavior across retail business operations. Knowledgeable power over artificial intelligence assistants can decrease consumer risk perceptions. The impact of artificial intelligence-enabled checkouts develops on users' convenience perception. Artificial intelligence customer service optimization may not find a solution to personalized problems, while being strict and impersonal.

Retail e-commerce business harnesses machine learning and neural networks (Shaikh et al., 2022; Xu et al., 2022; Yang et al., 2022) to inspect buyer behavior and engage consumers adequately so as to provide optimized products and value-added services to satisfy their demands, enhancing operational efficiencies. Concerning increased perceived control, users rely on artificial intelligence service agents having human-like designs to deliver the goods more effectively and incline towards quite anthropomorphic ones. Customer brand perception and satisfaction can be carried out according to machine learning algorithms and big data.

Artificial intelligence technologies can track and grasp (Alimamy and Gnoth, 2022; Rabassa et al., 2022; Rodgers and Nguyen, 2022) consumer decision process and journey. Algorithm-based voice assistants may result in perceived discriminatory offers as regards user perception of conversational commerce technology and menu item choice. Customer personalization perceptions are related to co-creation intention in web-based shopping. (Table 4)

Table 4 Synopsis of evidence as regards focus topics and descriptive outcomes (research findings)

Predictive analytics, automated decision-making processes, and machine and deep learning techniques can be deployed in user interaction, purchase intention, and consumer behavior across retail business operations.	Ghazwani et al., 2022; Hu et al., 2022; Sharma and Shafiq, 2022; Zhao et al., 2022
Retail e-commerce business harnesses machine learning and neural networks to inspect buyer behavior and engage consumers adequately so as to provide optimized products and value-added services to satisfy their demands, enhancing operational efficiencies.	Shaikh et al., 2022; Xu et al., 2022; Yang et al., 2022
Artificial intelligence technologies can track and grasp consumer decision process and journey. Customer personalization perceptions are related to co-creation intention in web-based shopping.	Alimamy and Gnoth, 2022; Rabassa et al., 2022; Rodgers and Nguyen, 2022

6. Data-driven Retail Innovations and Machine Learning Technologies in Digital Customer Service

Digital technology and artificial intelligence tools (Giroux et al., 2022; Hallows et al., 2022; Rodgers and Nguyen, 2022) can be harnessed routinely throughout the lifecycle management processing and supervision and quality assurance of products, and massive volumes of synthetic data should be handled instantaneously to reduce disruptions, optimize convenience, and secure earnings by scanning, identifying, and classifying features. Users' moral concerns and behaviors are dissimilar when engaging with machine learning agents and self-service technologies in opposition to humans. Artificial intelligence technologies assist in post-purchase by use of chatbots to decrease resolution time as regards subsequent inquiries or handle post-purchase actions.

Machine learning methods (Bai, 2022; Hossain and Rahman, 2022; Lv et al., 2022) are pivotal in defining customer sentiment, empathetic behavioral reactions, and emotional experiences. Artificial intelligence payment tools may increase willingness to buy quickly or over-purchase, optimizing consumption of goods and services in terms of utility, shaping online consumption pattern behaviors and consumer purchase decisions. Artificial intelligence services support customer continuous usage intention and emotional response through multisensory interaction.

Data-driven retail innovations (Battisti et al., 2022; Crolic et al., 2022; Rodgers and Nguyen, 2022) can enhance sales performance, customer engagement, and store shopping experience by use of machine learning tools, indoor location analytics, cutting-edge purchase techniques, and scalable showroom services. Chatbots are pivotal in digital customer service in terms of purchase intentions through machine learning technologies. User decision-making algorithms throughout the online environment can be pivotal in artificial intelligence technologies to more thoroughly grasp the consumer journey. (Table 5)

Table 5 Synopsis of evidence as regards focus topics and descriptive outcomes (research findings)

Digital technology and artificial intelligence tools can be harnessed routinely throughout the lifecycle management processing and supervision and quality assurance of products.	Giroux et al., 2022; Hallows et al., 2022; Rodgers and Nguyen, 2022
Machine learning methods are pivotal in defining customer sentiment, empathetic behavioral reactions, and emotional experiences.	Bai, 2022; Hossain and Rahman, 2022; Lv et al., 2022
Data-driven retail innovations can enhance sales performance, customer engagement, and store shopping experience.	Battisti et al., 2022; Crolic et al., 2022; Rodgers and Nguyen, 2022

7. Discussion

We integrate our systematic review throughout research indicating how collaborative data-driven tools can assist in developing employee–customer interaction. Our research complements recent analyses clarifying how online purchasing intentions, choices, behaviors, patterns, and habits can be configured by machine learning and neural networks. We elucidate, by cumulative evidence, previous research demonstrating how the impact of artificial intelligence-enabled checkouts develops on users' convenience perception.

8. Synopsis of the Main Research Outcomes

With growing evidence of algorithmic shopping decision journeys, there is a pivotal need for comprehending the relationship between consumer engagement, experience, and purchase behaviors. Artificial intelligence payment tools may increase willingness to buy quickly or over-purchase, optimizing consumption of goods and services in terms of utility, shaping online consumption pattern behaviors and consumer purchase decisions. By use of data gathering and analysis, data-driven retail innovations can articulate content production, shopping, and interaction.

9. Conclusions

Relevant research has investigated whether artificial intelligence services support customer continuous usage intention through machine learning agents and self-service technologies. This systematic literature review presents the published peer-reviewed sources covering customer personalization perceptions in web-based shopping related to predictive analytics, automated decision-making processes, and machine and deep learning techniques in retail e-commerce business. The research outcomes drawn from the above analyses indicate that customer brand perception and satisfaction can be carried out according to machine learning algorithms and big data.

10. Limitations, Implications, and Further Directions of Research

By analyzing only articles published in journals indexed in the Web of Science, Scopus, and ProQuest databases in 2022, relevant sources on data-driven machine learning and neural network algorithms in the retailing environment may have been excluded. Limitations of this research comprise particular kinds of publications (original empirical research and review articles) discounting others (conference proceedings articles, books, and editorial materials). The scope of our study also does not move forward the inspection of user interaction, purchase intention, and consumer behavior

across retail business operations through virtual and augmented reality technologies.

Subsequent analyses should develop on algorithmic shopping decision journeys by use of digital technology and artificial intelligence tools. Future research should thus investigate artificial intelligence customer service optimization. In the future, attention should be directed to refashioning and co-creation purposes in web-based shopping through machine learning and neural networks.

Tomas Kliestik, https://orcid.org/0000-0002-3815-5409
Katarina Zvarikova, https://orcid.org/0000-0001-5278-9275
George Lăzăroiu, https://orcid.org/0000-0002-3422-6310

Compliance with ethical standards
This article does not contain any studies with human participants or animals performed by the authors.

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All authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication. The authors take full responsibility for the accuracy and the integrity of the data analysis.

Conflict of interest statement
The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Disclosure by the editors of record
The editors declare no conflict of interest in the review and publication decision regarding this article.

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