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Challenges and Opportunities for Implementing AI in Clinical Trials

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Abstract

The pharmaceutical industry is under immense pressure to accelerate drug development, reduce costs, and improve the success rate of clinical trials, which remain notoriously slow, expensive, and prone to failure. Artificial intelligence (AI) offers a transformative opportunity to address these long-standing challenges. This paper provides a comprehensive overview of the key opportunities and challenges associated with implementing AI throughout the clinical trial lifecycle. We highlight how AI can optimize trial design, streamline patient recruitment and retention, enhance real-time safety monitoring, and accelerate data analysis from various sources, including electronic health records and wearable devices. These applications promise to make trials more efficient, personalized, and patient-centric. We discuss the need for robust governance and validation processes to ensure patient safety and build trust among all stakeholders. Ultimately, while AI holds immense potential to revolutionize clinical research, its successful implementation requires a concerted effort to address these challenges through collaboration, transparency, and the development of responsible AI practices.

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Introduction

The process of bringing a new drug or medical device to market is a long, expensive, and high-risk endeavor. Central to this process are clinical trials, which are designed to rigorously test the safety and efficacy of new interventions. However, the traditional clinical trial model is facing significant challenges. The average cost to develop a single drug has soared to billions of dollars, and the clinical phase alone can take over a decade to complete. A staggering number

of trials fail due to a variety of factors, including low patient enrollment, high dropout rates, and inadequate data analysis. These inefficiencies not only strain resources but also delay the delivery of potentially life-saving treatments to patients [1-29].

In the face of these persistent hurdles, artificial intelligence (AI) has emerged as a transformative technology with the potential to revolutionize every stage of the clinical trial lifecycle. AI, encompassing machine learning, natural language processing, and other computational methods, can process and analyze vast quantities of data at a scale and speed that is simply impossible for humans. By applying these technologies, researchers and trial sponsors can move beyond the limitations of traditional, manual processes and embrace a more data-driven, efficient, and patient-centric approach. This paper explores the specific opportunities that AI presents for clinical trials while also addressing the significant challenges that must be overcome for its successful and responsible implementation [30-45].

Opportunities for AI Across the Clinical Trial Lifecycle

The application of AI begins well before the first patient is enrolled. In the pre-trial phase, AI can dramatically optimize trial design. Machine learning models can analyze existing clinical data, genomic information, and real-world evidence to identify the most promising patient populations, predict potential drug-drug interactions, and even simulate trial outcomes, thereby increasing the probability of success. For example, AI can help in selecting optimal endpoints and dosage regimens, which are critical to a trial's success. This data-driven approach replaces much of the trial-and-error methodology that has historically characterized drug development.

One of the most significant bottlenecks in clinical research is patient recruitment and retention. Up to 80% of trials fail to meet their enrollment timelines, often because finding and qualifying eligible patients is a manual, resource-intensive process. AI can change this by using natural language processing (NLP) to screen unstructured notes in electronic health records (EHRs) and other medical databases to quickly identify potential candidates based on complex inclusion and exclusion criteria. Furthermore, AI-powered tools can analyze demographic data and social media to locate and engage with patient communities, improving outreach and boosting enrollment rates. During the trial, AI can predict which patients are at a higher risk of dropping out, allowing trial staff to intervene proactively with personalized support, thereby improving retention and data integrity [46-58].

Throughout the trial, AI enhances data collection and analysis. The shift to remote and decentralized trials has introduced new data streams from wearable devices, sensors, and mobile apps. AI algorithms are uniquely suited to process this continuous flow of high-volume, real-time data, providing a more comprehensive and accurate picture of a patient's health and response to treatment. This allows for more effective real-time safety monitoring, where AI can flag adverse events earlier than traditional methods, leading to faster interventions and improved patient safety. Finally, in the post-trial phase, AI accelerates the final data analysis and reporting. Machine learning models can identify subtle but significant patterns in trial data that might be missed by human analysts, leading to more robust conclusions and a deeper understanding of the drug's effects.

Navigating the Challenges: The Path to Responsible AI

Despite these compelling opportunities, the widespread implementation of AI in clinical trials is not without its hurdles. The first set of challenges are technical and data-related. AI models are only as good as the data they are trained on. Clinical data is often fragmented, incomplete, and of varying quality, which can lead to biased or inaccurate models. The lack of interoperability between different healthcare systems further complicates the process of aggregating the necessary large and diverse datasets. Without standardized data formats and ethical data-sharing protocols, the full potential of AI cannot be realized [59-69].

Beyond the technical issues, significant ethical and regulatory challenges must be addressed. Patient data privacy is paramount, and the use of large datasets for AI development raises concerns about de-identification and security. The "black box" nature of many deep learning models, where the reasoning behind a decision is not easily understood, presents a major obstacle. Clinicians and regulatory bodies need to trust and validate the recommendations made by AI systems

which requires a move toward explainable AI (XAI). Furthermore, the regulatory landscape for AI in medicine is still evolving. Clear guidelines are needed to define how AI-driven insights should be used in regulatory submissions and what level of validation is required to ensure patient safety [70-81].

Challenges

Implementing AI in clinical trials faces significant challenges across four main areas: technical and data issues, ethical and regulatory hurdles, organizational factors, and a lack of trust and transparency.

Technical and Data Challenges

The success of AI models hinges on the quality and quantity of the data they are trained on. However, clinical trial data often presents significant problems.

- **Data Quality and Interoperability:** Clinical data is frequently inconsistent, incomplete, and stored in disparate systems (data silos). This lack of standardization and interoperability makes it difficult to aggregate the large, high-quality datasets needed to train robust AI models.
- **Algorithmic Bias:** If AI models are trained on data from a non-diverse patient population, they may develop biases that lead to inaccurate or unfair outcomes for underrepresented groups, potentially worsening healthcare disparities.
- **Unstructured Data:** Much of the valuable information in clinical trials is found in unstructured text, such as physician's notes. While natural language processing (NLP) is used, accurately extracting and standardizing this information remains a complex task.

Ethical and Regulatory Hurdles

Using AI in clinical trials introduces new ethical and legal questions that require careful consideration.

- **Data Privacy and Security:** Clinical trial data is highly sensitive. The use of large datasets for AI development raises serious concerns about patient privacy and the risk of data breaches. While de-identification is a common practice, the risk of re-identification is a real and growing concern [82-90].
- **Accountability and Liability:** It is currently unclear who is responsible when an AI-driven decision leads to an adverse event or a poor outcome. Is it the developer, the trial sponsor, or the clinician who used the AI tool? The lack of a clear legal framework for AI-related errors is a major barrier to adoption.
- **Regulatory Uncertainty:** The regulatory landscape for AI in medicine is still in its infancy. There is a lack of clear guidance from regulatory bodies like the FDA on how to validate AI models and what evidence is required to use AI-driven insights in regulatory submissions. This uncertainty slows down innovation and implementation.

Organizational and Human Factors

Successfully integrating AI into clinical trials requires more than just good technology; it demands a shift in organizational culture and human factors.

- **Lack of Collaboration:** A communication gap often exists between AI researchers and clinical professionals. Researchers may not fully understand clinical workflows, and clinicians may not be familiar with the capabilities and limitations of AI. This "cognitive mismatch" can hinder effective collaboration.
- **Workflow Integration:** AI tools must seamlessly fit into existing clinical workflows without adding to the already heavy workload of research staff. Tools that are difficult to use or require significant extra steps are unlikely to be adopted.
- **Clinician Skepticism:** Many clinicians are skeptical of AI, especially "black box" models that don't explain their reasoning. This lack of transparency can erode trust and lead to resistance in adopting these new tools.

Trust and Transparency

For AI to be a reliable partner in clinical trials, its decision-making processes must be transparent and understandable.

- **The "Black Box" Problem:** Many advanced AI models, particularly deep learning systems, are opaque and cannot provide a clear explanation for their outputs. This lack of transparency makes it difficult for human experts to validate the AI's recommendations, which is crucial for building trust and ensuring patient safety.
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- **Explainable AI (XAI):** The field of XAI is working to address this by developing models that can provide human-readable explanations. However, creating XAI tools that are both accurate and clinically useful remains an ongoing research challenge.

Future Works

Future work in implementing AI in clinical trials should concentrate on addressing the key challenges while building on current opportunities. The primary focus areas should be technical and ethical, moving the field towards more robust, transparent, and user-friendly AI solutions.

Advancing Explainable AI (XAI) and Validation

A major area for future work is the development of Explainable AI (XAI). This is crucial for building trust with clinicians, regulatory bodies, and patients. Future research should focus on creating models that can not only make predictions but also provide clear, human-readable rationales for their decisions. This would allow a clinician to understand why an AI system flagged a patient for an adverse event or suggested a particular treatment path. Additionally, future work needs to establish clear, standardized methodologies for validating AI models. These validation frameworks must go beyond simple accuracy metrics and consider factors like generalizability across diverse populations and the real-world clinical impact of the AI's recommendations.

Improving Data Interoperability and Synthetic Data Generation

The issue of data silos and poor data quality is a fundamental bottleneck. Future work should prioritize the creation of federated learning frameworks. These systems allow AI models to be trained on data from multiple institutions without the sensitive patient data ever having to leave its source. This addresses privacy concerns while still enabling the use of large, diverse datasets. Another promising avenue is the use of synthetic data. Researchers can train generative AI models to create realistic, but completely artificial, patient data. This synthetic data can be used to augment real datasets, helping to address issues of data scarcity and bias, and can be shared more freely for research without compromising patient privacy.

Developing a Robust Regulatory and Ethical Framework

Future work must involve a collaborative effort between researchers, industry, and regulatory bodies to create a clear and predictable regulatory framework for AI in clinical trials. This includes defining the standards for model validation, documentation, and the level of human oversight required for AI-driven decisions. The framework must also address the ethical dimensions, such as creating systems for monitoring and mitigating algorithmic bias and establishing clear lines of accountability when AI models are used. This will not only ensure patient safety but also provide a clear pathway for companies to bring their AI innovations to market.

Creating User-Centric AI Tools and Training

Finally, future work should focus on making AI a seamless and valuable part of the clinical trial workflow. This means designing AI tools with a strong emphasis on user experience, ensuring they are intuitive and do not add to the administrative burden of research staff. Furthermore, there is a critical need for education and training to bridge the gap between AI researchers and clinical professionals. Future work should include developing training programs that equip clinicians and trial staff with the skills to understand, evaluate, and

effectively use AI tools, ensuring a truly collaborative relationship between human expertise and machine intelligence.

Conclusion

In conclusion, the future of clinical trials is inextricably linked to the responsible integration of AI. While the opportunities for transformation are vast, they must be pursued with a clear understanding of the risks and a commitment to ethical, transparent, and user-centric development. By addressing these challenges head-on, we can move beyond the current inefficiencies and usher in an era where AI is not just a tool for automation but a true partner in accelerating medical breakthroughs, ultimately leading to better and faster outcomes for patients.

References

1. Maryam Gholizadeh, Dr Omid Panahi (2021) Investigating System in Health Management Information Systems, Scholars Press Academic Publishing. ISBN: 978- 613-8-95240-4.
2. Maryam Gholizadeh, Dr Omid Panahi (2021) Untersuchungssystem im Gesund heits management Informations systeme, Unser wissen Publishing. ISBN: 978-620-3-67046-2.
3. Maryam Gholizadeh, Dr Omid Panahi (2021) Sistema de investigación en sistemas de información de gestión sanitaria, NUESTRO CONOC, MENTO Publishing. ISBN: 978-620-3-67047-9.
4. Maryam Gholizadeh, Dr Omid Panahi (2021) Système d'investigation dans les systèmes d'information de gestion de la santé, EDITION NOTRE SAVOIR Publishing. ISBN: 978-620-3-67048-6.
5. Maryam Gholizadeh, Dr Omid Panahi (2021) Indagare il sistema nei sistemi informativi di gestione della salute, SAPIENZA Publishing. ISBN: 978-620-3-67049-3.
6. Maryam Gholizadeh, Dr Omid Panahi (2021) Systeemonderzoek in Informatiesystemen voor Gezondheidsbeheer, ONZE KENNIS Publishing. ISBN: 978-620-3-67050-9.
7. Maryam Gholizadeh, Dr Omid Panahi (2021) System badawczy w systemach informacyjnych zarządzania zdrowiem, NAZSA WIEDZA Publishing. ISBN: 978-620-3-67051-6.
8. Dr Omid Panahi, Dr Faezeh Esmaili, Dr Sasan Kargarnezhad (2024) Artificial Intelligence in Dentistry, SCIENCIA SCRIPTS Publishing. ISBN: 978-620-6622801.
9. Dr Shima Esmaielzadeh, Dr Omid Panahi, Dr Fatmanur Ketenci Çay, (2020), Application of Clay's in Drug Delivery in Dental Medicine, Scholars Press Academic Publishing. ISBN:978-613-8-94058-6.
10. Panahi O (2025) The evolving partnership: surgeons and robots in the maxillofacial operating room of the future. J Dent Sci Oral Care 1: 1-7.
11. O. Panahi (2025) The Future of Medicine: Converging Technologies and Human Health. Journal of Bio-Med and Clinical Research. RPC Publishers 2.
12. O. Panahi (2025) Nanomedicine: Tiny Technologies, Big Impact on Health. Journal of Bio-Med and Clinical Research. RPC Publishers 2.
13. O. Panahi (2025) The Age of Longevity: Medical Advances and The Extension of Human Life. Journal of Bio-Med and Clinical Research. RPC Publishers 2.
14. Panahi O (2025) Predictive Health in Communities: Leveraging AI for Early Intervention and Prevention. Ann Community Med Prim Health Care 3: 1027.
15. Panahi O (2025) Digital Health Equity: Leveraging IT and AI for Community Well-being. Ann Community Med Prim Health Care 3: 1028.
16. Koyuncu B, Gokce A, Panahi P (2015) The use of the Unity game engine in the reconstruction of an archeological site. In 19th Symposium on Mediterranean Archaeology (SOMA 2015) 95-103.
17. Koyuncu B, Meral E, Panahi P (2015) Real time geolocation tracking by using GPS+GPRS and Arduino based SIM908. IFRSA International Journal of Electronics Circuits and Systems (IIJECS) 4: 148-150.
18. Koyuncu B, Uğur B, Panahi P (2013) Indoor location determination by using RFIDs. International Journal of Mobile and Adhoc Network (IJMAN) 3: 7-11.
19. Omid Panahi (2025) The Impact of Artificial Intelligence in Medical Diagnosis. Int J Nurs Health Care 2: 1-4.
20. Omid Panahi (2025) The AI Revolution in Healthcare. Int J Nurs Health Care 2: 1-4.
21. Omid Panahi (2025) Beyond the Bedside: How Future Tech is Revolutionizing Medical Care. Int J Nurs Health Care 2: 1-4.
22. Omid Panahi (2025) The Algorithmic Clinician:

AI's Transformative Role in Modern Medicine. Int J Nurs Health Care 2: 1-4.
23. Omid Panahi, Zahra Shahbazpour (2025) Healthcare Reimagined: AI and the Future of Clinical Practice. Am J Biomed Sci & Res.
24. Panahi O (2025) Smart Implants: Integrating Sensors and Data Analytics for Enhanced Patient Care. Dental 7: 22.
25. Panahi DU, HOC A (2025) Networks: Applications. Challenges, Future Directions, Scholars' Press, ISBN 978-973.
26. Omid Panahi (2024) Teledentistry: Expanding Access to Oral Healthcare. Journal of Dental Science Research Reviews & Reports. SRC/JDSR-203.
27. Omid P, Reza S (2024) How Artificial Intelligence and Biotechnology are Transforming Dentistry. Adv Biotech & Micro 18: 555981.
28. Omid Panahi (2024) "AI: A New Frontier in Oral and Maxillofacial Surgery". Acta Scientific Dental Sciences 8.6: 40-42.
29. Omid Panahi, Reza Safaralizadeh (2024) AI and Dental Tissue Engineering: A Potential Powerhouse for Regeneration. Mod Res Dent 8.
30. Omid Panahi (2024) Artificial Intelligence: A New Frontier in Periodontology. Mod Res Dent 8.
31. Omid P (2024) Empowering Dental Public Health: Leveraging Artificial Intelligence for Improved Oral Healthcare Access and Outcomes. JOJ Pub Health 9: 555754.
32. Omid P (2024) Artificial Intelligence in Oral Implantology, Its Applications, Impact and Challenges. Adv Dent & Oral Health 17: 555966.
33. 33. Omid Panahi (2024) "AI Ushering in a New Era of Digital Dental-Medicine". Acta Scientific Medical Sciences 8.8: 131-134.
34. Panahi O, Zeinaldin M (2024) AI-Assisted Detection of Oral Cancer: A Comparative Analysis. Austin J Pathol Lab Med 10: 1037.
35. Panahi O (2024) AI in Surgical Robotics: Case Studies. Austin J Clin Case Rep 11: 1342.
36. Panahi O, Zeinaldin M (2024) Digital Dentistry: Revolutionizing Dental Care. J Dent App 10: 1121.
37. Panahi O (2025) Wearable Sensors and Personalized Sustainability: Monitoring Health and Environmental Exposures in Real-Time. European Journal of Innovative Studies and Sustainability P1: 1-19.
38. Omid Panahi, Sevil Farrokh (2024) USAG-1-Based Therapies: A Paradigm Shift in Dental Medicine. Int J Nurs Health Care 1: 1-4.
39. Omid Panahi, Sevil Farrokh (2024) Can AI Heal Us? The Promise of AI-Driven Tissue Engineering. Int J Nurs Health Care 1: 1-4.
40. O Panahi (2025) Algorithmic Medicine, Journal of Medical Discoveries 2.
41. O Panahi (2025) Deep Learning in Diagnostics, Journal of Medical Discoveries 2.
42. Omid P, Soren F (2025) The Digital Double: Data Privacy, Security, and Consent in AI Implants West J Dent Sci 2: 108.
43. Panahi O (2023) Ketenci Çay F. NanoTechnology. Regenerative Medicine and Tissue Bio-Engineering. Acta Sci Dent Sci 7: 118-122.
44. Panahi O (2025) Smart Robotics for Personalized Dental Implant Solutions. Dental 7.
45. Panahi P, Bayılmış C, Çavuşoğlu U, Kaçar S (2021) Performance evaluation of lightweight encryption algorithms for IoT-based applications. Arabian Journal for Science and Engineering 46: 4015-4037.
46. Panahi U, Bayılmış C (2023) Enabling secure data transmission for wireless sensor networks based IoT applications. Ain Shams Engineering Journal 14: 101866.
47. Omid Panahi, and Uras Panahi (2025) AI-Powered IoT: Transforming Diagnostics and Treatment Planning in Oral Implantology. J AdvArtifIntell Mach Learn 1: 1-4.
48. Panahi P, Dehghan M (2008) Multipath Video Transmission Over Ad Hoc Networks Using Layer Coding And Video Caches. In ICEE2008, 16th Iranian Conference On Electrical Engineering 50-55.
49. bakikoyuncu, pejmanpanahi Kalman (2014) Filtering of Link Quality Indicator Values for Position Detection by Using WSNS, Int'l Journal of Computing, Communications & Instrumentation Engg. (IJCCIE) 1.
50. Pejman Panahi, Cneyt Baylm (2017) "Car indoor gas detection system", International Conference on Computer Science and Engineering (UBMK.
51. Panahi P (2009) Providing consistent global sharing service over VANET using new plan. In 2009 14th International CSI Computer Conference. IEE 213-218.

52. Panahi P (2008) Multipath local error management technique over ad hoc networks. In 2008 International Conference on Automated Solutions for Cross Media Content and Multi-Channel Distribution 187-194.
53. Dr Uras Panahi, Redes AD HOC: Aplicações, Desafios, Direcções Futuras, Edições Nosso Conhecimento, ISBN: 978-620-8-72962-2.
54. Dr Uras Panahi, Sieci AD HOC: Zastosowania, wyzwania, przyszłe kierunki, Wydawnictwo Nasza Wiedza, ISBN: 978-620-8-72967-7.
55. Dr Uras Panahi, Reti AD HOC: Applicazioni, sfide e direzioni future, Edizioni Sapienza, ISBN: 978-620-8-72965-3.
56. Dr Uras Panahi, Redes AD HOC: Aplicaciones, retos y orientaciones futuras, Ediciones Nuestro Conocimiento, ISBN: 978-620-8-72966-0.
57. Dr Uras Panahi, Réseaux AD HOC: Applications, défis et orientations futures, Editions Notre Savoir, ISBN: 978-620-8-72964-6.
58. Dr Uras Panahi, AD HOC-Netze: Anwendungen, Herausforderungen, zukünftige Wege, Verlag Unser Wissen, ISBN: 978-620-8-72963-9.
59. Dr Omid Panahi, Dr Faezeh Esmaili, Dr Sasan Kargarnezhad (2024) Künstliche Intelligenz in der Zahnmedizin, Unser wissen Publishing. ISBN: 978-620-3-6722696.
60. Dr Omid Panahi, Dr Faezeh Esmaili, Dr Sasan Kargarnezhad (2024) Artificial Intelligence in Dentistry, Scholars Press Publishing. ISBN: 978-620-6772118.
61. Dr Omid Panahi, Dr Faezeh Esmaili, Dr Sasan Kargarnezhad (2024) Inteligencia artificial en odontología, NUESTRO CONOC, MENTO Publishing. ISBN: 978-620-6622764.
62. Dr Omid Panahi, Dr Faezeh Esmaili, Dr Sasan Kargarnezhad (2024) L'intelligence artificielle dans l'odontologie, EDITION NOTRE SAVOIR Publishing Publishing. ISBN: 978-620-6622771.
63. Dr Omid Panahi, Dr Faezeh Esmaili, Dr Sasan Kargarnezhad (2024) Intelligenza artificiale in odontoiatria, SAPIENZA Publishing. ISBN: 978-620-6622788.
64. Dr Omid Panahi, Dr Faezeh Esmaili, Dr Sasan Kargarnezhad (2024) Inteligência Artificial em Medicina Dentária, NOSSO CONHECIMENTO Publishing. ISBN: 978-620-6622795.
65. Dr Omid Panahi, Dr Sevil Farrokh Eslamlou, Peridontium: Estrutura, função e gestão clínica, lSBN: 978-620-8-74561-5.
66. Dr Omid Panahi, Dr Shabnam Dadkhah, AI in der modernen Zahnmedizin, ISBN:978-620-8-74877-7.
67. Dr Omid Panahi, Dr Shabnam Dadkhah, La IA en la odontología moderna, ISBN:978-620-8-74881-4.
68. Dr Omid Panahi, Dr Shabnam Dadkhah, L'IA dans la dentisterie moderne, ISBN:978-620-8-74882-1.
69. Dr Omid Panahi, Dr Shabnam Dadkhah, L'intelligenza artificiale nell'odontoiatria moderna, ISBN:978-620-8-74883-8.
70. Dr Omid Panahi, Dr Shabnam Dadkhah, Sztuczna inteligencja w nowoczesnej stomatologii, ISBN:978-620-8-74884-5.
71. Dr Omid Panahi, Dr Shabnam Dadkhah, A IA na medicina dentária moderna, ISBN:978-620-8-74885-2.
72. Dr Omid Panahi, Dr Sevil Farrokh Eslamlou, Dr Masoumeh Jabbarzadeh, Digitale Zahnmedizin und künstliche Intelligenz, ISBN: 978-620-8-73910-2.
73. Dr Omid Panahi, Dr Sevil Farrokh Eslamlou, Dr Masoumeh Jabbarzadeh, Odontología digital e inteligencia artificial, ISBN: 978-620-8-73911-9.
74. Dr Omid Panahi, Dr Sevil Farrokh Eslamlou, Dr Masoumeh Jabbarzadeh, Dentisterie numérique et intelligence artificielle, ISBN: 978-620-8-73912-6.
75. Dr Omid Panahi, Dr Sevil Farrokh Eslamlou, Dr Masoumeh Jabbarzadeh, Odontoiatria digitale e intelligenza artificiale, ISBN: 978-620-8-73913-3.
76. Dr Omid Panahi, Dr Sevil Farrokh Eslamlou, Dr Masoumeh Jabbarzadeh, Stomatologia cyfrowa i sztuczna inteligencja, ISBN: 978-620-8-73914-0.
77. Dr Omid Panahi, Dr Sevil Farrokh Eslamlou, Dr Masoumeh Jabbarzadeh, Medicina dentária digital e inteligência artificial, ISBN: 978-620-8-73915-7.
78. Dr Omid Panahi, Stammzellen aus dem Zahnmark, ISBN: 978-620-4-05355-4.
79. Dr Omid Panahi, Células madre de la pulpa dental, ISBN: 978-620-4-05356-1
80. Dr Omid Panahi, Стволовые клетки пульпы зуба, ISBN: 978-620-4-05357-8.
81. Dr Omid Panahi, Cellules souches de la pulpe dentaire, ISBN: 978-620-4-05358-5.
82. Dr Omid Panahi, Cellule staminali della polpa dentaria, ISBN: 978-620-4-05359-2.

83. Dr Omid Panahi, Dr Sevil Farrokh Eslamlou, Peridontium: Struktur, Funktion und klinisches Management, ISBN:978-620-8-74556-1.
84. Dr Omid Panahi, Dr Sevil Farrokh Eslamlou, Peridoncio: Estructura, función y manejo clínico, ISBN:978-620-8-74557-8.
85. Dr Omid Panahi, Dr Sevil Farrokh Eslamlou, Le péridontium : Structure, fonction et gestion clinique, ISBN:978-620-8-74558-5.
86. Dr Omid Panahi, Dr Sevil Farrokh Eslamlou, Peridonio: Struttura, funzione e gestione clinica, ISBN:978-620-8-74559-2.
87. Dr Omid Panahi, Dr Sevil Farrokh Eslamlou, Peridontium: Struktura, funkcja i postępowanie kliniczne, ISBN:978-620-8-74560-8.
88. Maryam Gholizadeh, Dr Omid Panahi (2021) Sistema de Investigação em Sistemas de Informação de Gestão de Saúde, NOSSO CONHECIMENTO Publishing. ISBN: 978-620-3-67052-3.
89. Maryam Gholizadeh, Dr Omid Panahi (2021) Система исследований в информационных системах управления здравоохранением , SCIENCIA SCRIPTS Publishing. ISBN: 978-620-3-67053-0.
90. Dr Leila Ostovar, Dr Kamal Khadem Vatan, Dr Omid Panahi (2020) Clinical Outcome of Thrombolytic Therapy, Scholars Press Academic Publishing. ISBN: 978-613-8- 92417-3.