

# Artificial Intelligence ChatGPT's Perspective on Implementation of Augmented Intelligence within Orthopaedic Practice—A Comparative Narrative Synthesis?

Neil Capes<sup>1\*</sup>, Hiran Patel<sup>1</sup>, Islam Sarhan<sup>1</sup>, Gur-Aziz S. Sidhu<sup>2</sup>, Neil Ashwood<sup>1,3</sup>, Andrew Dekker<sup>1</sup>

<sup>1</sup>Department of Trauma & Orthopaedics, University Hospitals Derby and Burton, Derby, United Kingdom

<sup>2</sup>Department of Trauma & Orthopaedics, University Hospital Lewisham, London, United Kingdom

<sup>3</sup>Research Institute, University of Wolverhampton, Wolverhampton, United Kingdom

Email: \*neil.capes@nhs.net, H.Patel10@wlv.ac.uk

**How to cite this paper:** Capes, N., Patel, H., Sarhan, I., Sidhu, G.-A.S., Ashwood, N. and Dekker, A. (2024) Artificial Intelligence ChatGPT's Perspective on Implementation of Augmented Intelligence within Orthopaedic Practice—A Comparative Narrative Synthesis? *Intelligent Information Management*, 16, 10-20.

<https://doi.org/10.4236/iim.2024.161002>

**Received:** November 22, 2023

**Accepted:** January 8, 2024

**Published:** January 11, 2024

Copyright © 2024 by author(s) and Scientific Research Publishing Inc. This work is licensed under the Creative Commons Attribution International License (CC BY 4.0).

<http://creativecommons.org/licenses/by/4.0/>



Open Access

---

## Abstract

ChatGPT has obvious benefits in the way it can interrogate vast amounts of reference information and utilise metadata generation to answer questions posed to it and is freely available having been developed through human feedback. Already there are ethical and practical implications on its impact on learning and research. Artificial Intelligence (AI) has been seen as a way of improving healthcare provision by delivering more robust outcomes but measuring these and implementing AI within this setting is at present limited and disjointed. Methods: ChatGPT was interrogated to see what it felt were the barriers to its implementation within healthcare and in particular orthopaedic practice. The evidence for this determination was then examined for validity and applicability for a practical roll out at a Trust, Regional or National level. Results: AI can synthesise a vast amount of information to help it answer specific questions. The context and structure of any question will determine the usefulness of the answer which can then be used to develop practical solutions based on experience and resource limitations. Conclusions: AI has a role in service development and can quickly focus a working group to areas to consider when practically implementing change.

## Keywords

Artificial Intelligence, ChatGPT

---

## 1. Introduction

As technology develops so does healthcare delivery through quality improvement and informatics but also newer techniques and improved diagnosis and investigation capabilities [1]. Artificial or augmented intelligence (AI) systems are revolutionising the analysis of large amounts of data including healthcare records, results or images in order to support clinical decision making and improve patient outcomes [2]. However there remain barriers to implementing this effectively due to inconsistencies in reporting or the models used across organisations [3]. In some areas such as robotic surgery implementation is more straight forwards with improvements in surgical precision and outcomes driving changes to practice [4]. Resources are finite within healthcare and in order to introduce widespread changes effectively, easily adoptable changes are put into practice without a clear strategic plan.

ChatGPT is the most up to date version of pre-training transformer (GPT-3) developed to mimic human language processing abilities using neural networks being trained on a vast repository of information from various sources including books and scientific articles [5]. As such chatGPT can process a search and interpret the relevant information to guide clinicians and improve practice faster but may not be able to provide the judgments to enact the advice derived from the available evidence [6].

This paper aims to explore the efficiency of AI against search engines like PUBMED and explore the barriers to implantation in orthopaedic practice.

## 2. Methods

### Search Strategy

Eligible studies were searched on Medline, EMBASE, and PsycINFO databases using the algorithm.

(exp Artificial Intelligence/((artificial or machine or comput\*) adj3 intelligence) ((machine or transfer or deep or hierarchical) adj3 learning).mp. or/1-3 exp Clinical Decision-Making/((decision making or decision-making) adj3 (clinical or medical)) ((judgement\* or reasoning or importance or relevance or significance) adj3 (clinical or medical))or/exp treatment outcome?(outcome\* or improv\* or result\* or effect\* or impact\*).mp. or/and exp Surgical Procedures, Operative/exp Surgery/surgery.mp. (surg\* or operat\*).mp. or/and exp Orthopedic Surgery/exp Orthopedics/ortho\*), (Table 1).

### Criteria

What are the barriers to implementation and enablers to using AI in medicine and is that the same for orthopaedics?

How do you verify the effectiveness and accuracy of AI decision making especially in orthopaedics?

How AI is being used in orthopaedic clinical practice and what is the potential for the future?

**Table 1.** Listing the comparative Chat GPT questions.

	Inclusion	Exclusion
Population	Artificial Intelligence Applications in Orthopaedic Surgery	Did not include deep learning/non AI patients/not orthopaedic related
Intervention	Clinical decision making/ Orthopaedic Surgery	Lacking clinical or orthopaedic context
Environment	Accessible either in hospital, or in a general practice or outpatients	External applications
Outcomes	Reported on outcomes, barriers or facilitators to AI implementation related to clinical decisions in orthopaedics	Described only theoretical
Design	Reviews, randomised trials, and single cases	Did not report empirical data. Not in English
Published	Papers published up until March 2023	

The search generated 3565 papers when looking at artificial intelligence or deep learning on clinical decision making, however when looking specifically at the impact on orthopaedics 129 papers were identified by the librarian. The number of studies titles, abstract and full text were then screened to look at the content systematically and the reasons for exclusion were recorded at each stage (e.g., “non-surgery”). Two researchers participated in both titles, abstract and full-text screening stages (NC, NA), and where there was uncertainty in study eligibility, a consensus decision was made by at least two screeners. Endnote captured and managed the references at each stage of screening. The researchers (NC, NA) extracted the study design, intervention characteristics and details of outcomes assessed with an assessment of effectiveness.

In comparison ChatGPT was asked a series of questions designed to cover a similar area identified within the search string. Comparison was made for content and an algorithm constructed that might facilitate implementation of AI within orthopaedics.

### 3. Results

From the 129 articles were identified through the librarian search 38 eligible studies were identified as being relevant to informing the effective implantation of AI within orthopaedics. The following themes were identified from the papers and the results were compared with the points described by the AI.

#### Data Quality and Its Analysis

Chat GPT “*Data quality and availability: AI systems require large amounts of high-quality data to function effectively. However, medical data can be messy, incomplete, and inconsistent, which can limit the accuracy and effectiveness of AI systems.*”

*“Increased access to data: Advances in digital technologies have made it easier to collect, store, and share medical data, which can enable the development of more accurate and effective AI systems.”*

*“Improved algorithms: Advances in machine learning algorithms have improved the accuracy and effectiveness of AI systems in healthcare, enabling them to detect patterns and make predictions with greater precision.”*

Kambhampati and co-authors [7] have outlined the increase in exposure of orthopaedic surgeons to a wide variety of data of differing quality requiring a strategic approach to data handling, storing and analysis in order to achieve effective decision making. Orthopaedic Surgeons like all clinicians need to consider how to achieve effective data husbandry over the lifecycle of that data [8] as well as considering what is useful in facilitating clinical decision making and implementing effective treatment be it surgical or non-operative. Some data such as “big data” cannot be handled by simple computing methods as it involves billions of fields its analysis allows for strategic decision making that can inform service development to tackle patterns of disease or trauma presentation (Table 2) [9]. Introduction of AI and other computing systems, improved technology for imaging and diagnostics will ultimately transform the way surgeons plan and execute procedures on a more targeted predictable pathway [10]. In order to ensure this is handled appropriately there will be continued evolution in the way data is regulated around the world and the laws that underpin how data is controlled currently the following apply.

#### Legal and Ethical Challenges

Chat GPT *“Regulatory and legal challenges: There are various regulatory and legal challenges associated with the use of AI in medicine. For example, the lack of clear guidelines and standards for AI in healthcare can make it difficult for healthcare providers to navigate legal and regulatory frameworks.”*

*“Ethical concerns: The use of AI in healthcare raises several ethical concerns, such as privacy, fairness, and bias. For example, AI systems may perpetuate biases that exist in healthcare, leading to unequal treatment and outcomes.”*

Since AI is increasingly improving healthcare delivery and is becoming more mainstream the concerns raised about the algorithm structures and the potential for bias has become apparent [11]. The algorithms are constructed sometimes without training and therefore some regulatory rules which protect individuals or groups may not be considered by the programming when structuring healthcare delivery, a problem of “machine ignorance”. This being an omission error

**Table 2.** From Kambhampati et al. 2021 [9].

India	UK & EU	USA
<i>Information Technology Act, 2000</i>	Data Protection Act 1998	Health Insurance
<i>Personal Data Protection Bill, 2019</i>	Data Protection Act 2018	Portability and
<i>Information Technology Rules, 2021</i>	General Data Protection Regulation (GDPR)-EU	Accountability Act (HIPAA)

worst is where any programme has been subtly altered to benefit a specific population or worst exclude another which would be illegal and immoral. Sometimes it is difficult for the clinician to explain the decisions that have been made (Kempton *et al.* 2022) or validate them (Panch *et al.* 2019) and when the outcome is adverse unpicking how the decision was made can be difficult (Habli *et al.* 2020) [12] [13] [14]. So there remain some ethical and legal dilemmas about where the responsibility for the decision lies. Governance models have been proposed to prevent such problems [15] and implementing AI requires resources not just in terms of computer functionality.

#### Requirements to Implement AI Effectively

Chat GPT “*Limited technical expertise. The implementation of AI systems requires technical expertise, which may not be readily available within healthcare organizations.*”

“*Collaborative partnerships. Collaborative partnerships between healthcare providers, technology companies, and academic institutions can enable the development and implementation of AI systems in healthcare.*”

“*Improved regulatory frameworks. Clear guidelines and standards for the use of AI in healthcare can enable healthcare providers to navigate legal and regulatory frameworks more effectively.*”

Regulation exists to ensure safety as previously outlined [16] [17]. AI is successfully working within these frameworks improving data quality and analysis providing better reporting and even detecting alteration in herbal medicines used in the alternative medicine market [18]. While administrative tasks and data synthesis obviously plays to AI strengths diagnosis and treatment recommendations and patient engagement and adherence can be more difficult to achieve and monitor [19]. Innovation needs to be supported and can be achieved through a collaborative approach with products and therapies benefitting from iterative processes explored by academia and industry [20]. Achieving this interaction can be difficult despite it being a priority for the National Health Service (NHS). There are however a variety of ways AI being used in orthopaedics.

ChatGPT “*Diagnosis and treatment planning. AI systems can assist with the diagnosis and treatment planning of orthopaedic conditions by analysing medical images such as X-rays, CT scans, and MRIs. For example, AI algorithms can detect subtle changes in bone density that may indicate the early stages of osteoporosis or identify abnormal bone growth patterns that may suggest the presence of a tumour.*”

Diagnosis can be difficult sometimes within orthopaedics for instance in scaphoid fractures where image interpretation is difficult or the detection of infection or cancers [21] [22]. AI appears to be more accurate than non-specialised radiologists interpreting for scaphoid fractures [23]. Periprosthetic infections can be difficult to detect, and early treatment may prevent overwhelming sepsis and mortality [24]. AI has been used with sensitivity to review records and detect infection around prostheses with accuracy although further validation of

the algorithms has been recommended [25]. Bone cancer detection similarly is in evolution with AI having reasonable accuracy in determining abnormal from normal bone [26] the accuracy of which will improve as the dataset available improves.

ChatGPT “*Surgical planning and navigation: AI systems can also be used to plan and guide orthopaedic surgeries. For example, AI algorithms can help surgeons identify the optimal placement of screws and other hardware during joint replacement surgeries or assist with the planning and execution of complex spinal surgeries.*”

Improved accuracy of implant placement is believed to improve the stability and wear characteristics for implant outcomes and early recognition of excessive wear facilitates the manufacture of bespoke implants that achieve anatomical restoration that would not have been achievable with an off the shelf implant. Batailler and co-authors conclude in a systematic review of 132 articles found that “AI-based tools improve the decision-making process, surgical planning, accuracy, and repeatability of surgical procedures”. Accuracy of navigation and design of implants is believed to improve the outcome for joint replacements especially in the long term by reducing wear from mispositioning [27] [28].

ChatGPT “*Rehabilitation and post-operative care: AI systems can also be used to develop personalized rehabilitation plans for patients recovering from orthopaedic surgeries or injuries. For example, AI algorithms can analyse data from wearable sensors to monitor a patient’s progress during rehabilitation and adjust the treatment plan accordingly.*”

The use of Apps to monitor recovery and pick up those struggling is becoming more popular. Although not all patients consent to the use due to technical difficulties using apps there is a move to implanted sensors monitoring recovery such as step counts [29]. It can also aid in fracture recovery by encouraging those who maybe less confident in mobilising say after a hip fracture [30]. AI accurately predicts the length-of-stay and episode-of-care cost prediction with reportedly “excellent” validity [31].

Chat GPT “*Predictive analytics: AI can also be used to develop predictive models that can identify patients who are at higher risk of developing orthopaedic conditions such as osteoarthritis or stress fractures. This can enable health-care providers to intervene earlier and prevent or delay the onset of these conditions.*”

Arthroplasty surgeons’ determination of osteoarthritis grading is performed significantly quicker by AI [32].

#### 4. Discussion

Overall, AI has the potential to improve the accuracy and efficiency of orthopaedic care, leading to better outcomes for patients. ChatGPT has identified all the relevant dialogue within the literature in relation to orthopaedic practice and is a quick way to understand any issues or areas for development quickly and the

main relevant areas to practice. Both the literature review method and ChatGPT note that currently clinicians are helped most practically with the assistance AI gives in executing the surgery. Also during the pre-op planning phase, the AI algorithms aid surgeons by image segmentation and measurement of angular and more complex deformities evident on CT or MRI scan. This allows surgeons to plan the optimal placement of implants or the most effective surgical approach in arthroplasty and trauma surgery [33]. AI assists surgeons during the operation by providing real-time feedback and guidance [34]. In particular AI algorithms identify and track instruments, measure distances and angles, and highlight critical anatomical structures [35]. This helps surgeons make more precise and accurate cuts, reduce the risk of complications, and improve patient outcomes [36].

A further significant step identified by both review methods was the AIs ability to remote track patients' outcomes in real time. This is useful as the AI's ability to monitor recovery and those failing to progress by reviewing vast amounts of data comparing normal and abnormal recovery. Earlier interventions may prevent deterioration requiring complex interventions or revision. This helps clinicians as it is now possible for automatic identification of failure in hip replacement is possible with AI assistance including the development of infection or post operative dislocation [2] [37] [38] [39].

Patients on the other hand are aided by improved understanding of risk stratification preoperatively for arthroplasty cases based on demographics and co-morbidities this goes some way to enabling personalised care from diagnosis to treatment [5] [40]. There are some concerns however that the models developed have used "limited registry data", or that the models have been prematurely released when not fully validated, being developed not always with accurate data or the correct statistical regression [10] [15] [41] [42]. Adoption and evaluation for accuracy or effectiveness of AI in improving patients' care and clinical results has not yet happened robustly [43]. Verifying AI in clinical decision making involves a comprehensive evaluation process to ensure that the system performs accurately, reliably, and safely (ChatGPT). It is important to identify the clinical problem that the AI system is designed to address and define the intended objective of the system [44]. AI in supporting decision-making can help by reducing patient or clinician bias, process high-volume workloads without clinician fatigue, and holds the promise of even outperforming doctors in certain tasks. This then may facilitate clinicians being able to concentrate on other important tasks that improve patient care.

In conclusion there is a wide range of literature linking improved care pathways, processes and technique identified by the ChatGPT AI and this systematic narrative review. Applications in practice require a structured strategic approach to facilitate an effective improvement in clinical care within orthopaedics. Interrogating the AI enables clinicians to quickly identify areas for early improvement and areas where more caution may be required that would require a more

in-depth study of the literature otherwise.

## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

## References

- [1] Topol, E.J. (2019) High-Performance Medicine: The Convergence of Human and Artificial Intelligence. *Nature Medicine*, **25**, 44-56. <https://doi.org/10.1038/s41591-018-0300-7>
- [2] Ghassemi, M.M., Naumann, T., Schulam, P., Beam, A.L., Chen, I.Y., Ranganath, R. and Ossorio, N. (2019) Practical Guidance on Artificial Intelligence for Health-Care Data. *The Lancet Digital Health*, **1**, e157-e159. [https://doi.org/10.1016/S2589-7500\(19\)30084-6](https://doi.org/10.1016/S2589-7500(19)30084-6)
- [3] Cantiello, J., Kitsantas, P., Moncada, S. and Abdul, S. (2016) The Evolution of Quality Improvement in Healthcare: Patient-Centered Care and Health Information Technology Applications. *Journal of Hospital Administration*, **5**, 62-68. <https://doi.org/10.5430/jha.v5n2p62>
- [4] Polce, E.M., Kunze, K.N., Dooley, M.S., Piuze, N.S., Boettner, F. and Sculco, K. (2022) Efficacy and Applications of Artificial Intelligence and Machine Learning Analyses in Total Joint Arthroplasty: A Call for Improved Reporting. *JBJS*, **104**, 821-832. <https://doi.org/10.2106/JBJS.21.00717>
- [5] Bohr, A. and Memarzadeh, K. (2020) The Rise of Artificial Intelligence in Healthcare Applications. In: Bohr, A. and Memarzadeh, K., Eds., *Artificial Intelligence in Healthcare*, Academic Press, Cambridge, MA, 25-60. <https://doi.org/10.1016/B978-0-12-818438-7.00002-2>
- [6] Hussain, A., Malik, A., Halim, M.U. and Ali, A.M. (2014) The Use of Robotics in Surgery: A Review. *International Journal of Clinical Practice*, **68**, 1376-1382. <https://doi.org/10.1111/ijcp.12492>
- [7] Cascella, M., Montomoli, J., Bellini, V. and Bignami, E. (2023) Evaluating the Feasibility of ChatGPT in Healthcare: An Analysis of Multiple Clinical and Research Scenarios. *Journal of Medical Systems*, **47**, Article No. 33. <https://doi.org/10.1007/s10916-023-01925-4>
- [8] Kitamura, F.C. (2023) ChatGPT Is Shaping the Future of Medical Writing but Still Requires Human Judgment. *Radiology*, **307**, Article 230171. <https://doi.org/10.1148/radiol.230171>
- [9] Kambhampati, S.B.S., Vishwanathan, K., Patralekh, M.K. and Vaishya, R. (2021) Data for Orthopaedic Surgeons—A Review. *Journal of Clinical Orthopaedics & Trauma*, **21**, Article 101505. <https://doi.org/10.1016/j.jcot.2021.101505>
- [10] El Arass, M. and Souissi, N. (2018) Data lifecycle: From Big Data to Smartdata. 2018 *IEEE 5th International Congress on Information Science and Technology (CiSt)*, Marrakech, 21-27 October 2018, 80-87. <https://doi.org/10.1109/CIST.2018.8596547>
- [11] Haleem, A., Javaid, M., Khan, I.H. and Vaishya, R. (2020) Big Data Applications in Orthopaedics. *Journal of Orthopaedics and Spine*, **8**, 46-47. [https://doi.org/10.4103/joas.joas\\_42\\_19](https://doi.org/10.4103/joas.joas_42_19)
- [12] Lalehzarian, S.P., Gowd, A.K. and Liu, J.N. (2021) Machine Learning in Orthopaedic Surgery. *World Journal of Orthopedics*, **12**, 685-699.



- <https://doi.org/10.5312/wjo.v12.i9.685>
- [13] Borjali, A., Chen, A.F., Muratoglu, O.K., Morid, M.A. and Varadarajan, K.M. (2020) Deep Learning in Orthopedics: How Do We Build Trust in the Machine? *Health-care Transformation*. <https://doi.org/10.1089/heat.2019.0006>
- [14] Reddy, S., Allan, S., Coghlan, S. and Cooper, P. (2020) A Governance Model for the Application of AI in Health Care. *Journal of the American Medical Informatics Association*, **27**, 491-497. <https://doi.org/10.1093/jamia/ocz192>
- [15] Panch, T., Mattie, H. and Atun, R. (2019) Artificial Intelligence and Algorithmic Bias: Implications for Health Systems. *Journal of Global Health*, **9**, Article 010318. <https://doi.org/10.7189/jogh.09.020318>
- [16] Habli, I., Lawton, T. and Porter, Z. (2020) Artificial Intelligence in Health Care: Accountability and Safety. *Bulletin of the World Health Organization*, **98**, 251-256. <https://doi.org/10.2471/BLT.19.237487>
- [17] Kempt, H., Heiling, J.C. and Nagel, S.K. (2022) Relative Explainability and Double Standards in Medical Decision-Making: Should Medical AI Be Subjected to Higher Standards in Medical Decision-Making than Doctors? *Ethics and Information Technology*, **24**, Article No. 20. <https://doi.org/10.1007/s10676-022-09646-x>
- [18] Terry, N. (2019) Of Regulating Healthcare AI and Robots. *Yale Journal of Law & Technology*, **21**, 133. <https://doi.org/10.2139/ssrn.3321379>
- [19] Kalaiselvan, V., Sharma, A. and Gupta, S.K. (2021) "Feasibility Test and Application of AI in Healthcare"—With Special Emphasis in Clinical, Pharmacovigilance, and Regulatory Practices. *Health and Technology*, **11**, 1-15. <https://doi.org/10.1007/s12553-020-00495-6>
- [20] Davenport, T. and Kalakota, R. (2019) The Potential for Artificial Intelligence in Healthcare. *Future Healthcare Journal*, **6**, 94-98. <https://doi.org/10.7861/futurehosp.6-2-94>
- [21] Melese, T., Lin, S.M., Chang, J.L. and Cohen, N.H. (2009) Open Innovation Networks between Academia and Industry: An Imperative for Breakthrough Therapies. *Nature Medicine*, **15**, 502-507. <https://doi.org/10.1038/nm0509-502>
- [22] Cohen, M., Puntonet, J., Sanchez, J., Kierszbaum, E., Crema, M., Soyer, P. and Dion, E. (2023) Artificial Intelligence vs. Radiologist: Accuracy of Wrist Fracture Detection on Radiographs. *European Radiology*, **33**, 3974-3983. <https://doi.org/10.1007/s00330-022-09349-3>
- [23] Groot, O.Q., Bongers, M.E., Ogink, T., Senders, J.T., Karhade, A.V., Bramer, J.A., Verlaan, J.J. and Schwab, J.H. (2020) Does Artificial Intelligence Outperform Natural Intelligence in Interpreting Musculoskeletal Radiological Studies? A Systematic Review. *Clinical Orthopaedics and Related Research*, **478**, 2751-2764. <https://doi.org/10.1097/CORR.0000000000001360>
- [24] Zmistowski, B., Karam, J.A., Durinka, J.B., Casper, D.S. and Parvizi, J. (2013) Periprosthetic Joint Infection Increases the Risk of One-Year Mortality. *JBJS*, **95**, 2177-2184. <https://doi.org/10.2106/JBJS.L.00789>
- [25] Fu, S., Wyles, C.C., Osmon, D.R., Carvour, M.L., Sagheb, E., Ramazanian, T., Kremers, W.K., Lewallen, D.G., Berry, D.J., Sohn, S. and Kremers, H.M. (2021) Automated Detection of Periprosthetic Joint Infections and Data Elements Using Natural Language Processing. *The Journal of Arthroplasty*, **36**, 688-692. <https://doi.org/10.1016/j.arth.2020.07.076>
- [26] Sharma, A., Yadav, D.P., Garg, H., Kumar, M., Sharma, B. and Koundal, D. (2021) Bone Cancer Detection Using Feature Extraction Based Machine Learning Model.

- Computational and Mathematical Methods in Medicine*, **2021**, Article ID: 7433186.  
<https://doi.org/10.1155/2021/7433186>
- [27] Batailler, C., Shatrov, J., Sappey-Marini er, E., Servien, E., Parratte, S. and Lustig, S. (2022) Artificial Intelligence in Knee Arthroplasty: Current Concept of the Available Clinical Applications. *Arthroplasty*, **4**, Article No. 17.  
<https://doi.org/10.1186/s42836-022-00119-6>
- [28] St ockl, B., Nogler, M., Rosiek, R., Fischer, M., Krismser, M. and Kessler, O. (2004) Navigation Improves Accuracy of Rotational Alignment in Total Knee Arthroplasty. *Clinical Orthopaedics and Related Research*, **426**, 180-186.  
<https://doi.org/10.1097/01.blo.0000136835.40566.d9>
- [29] Lonner, J.H., Anderson, M.B., Redfern, R.E., Van Andel, D., Ballard, J.C. and Parratte, S. (2023) An Orthopaedic Intelligence Application Successfully Integrates Data from a Smartphone-Based Care Management Platform and a Robotic Knee System Using a Commercial Database. *International Orthopaedics*, **47**, 485-494.  
<https://doi.org/10.1007/s00264-022-05651-3>
- [30] Semple, J.L., Sharpe, S., Murnaghan, M.L., Theodoropoulos, J. and Metcalfe, K.A. (2015) Using a Mobile App for Monitoring Post-Operative Quality of Recovery of Patients at Home: A Feasibility Study. *JMIR mHealth and uHealth*, **3**, e3929.  
<https://doi.org/10.2196/mhealth.3929>
- [31] Gupta, A. and Al-Anbuky, A. (2021) IoT-Based Patient Movement Monitoring: The Post-Operative Hip Fracture Rehabilitation Model. *Future Internet*, **13**, Article 195.  
<https://doi.org/10.3390/fi13080195>
- [32] Wang, G.Y., Huang, W.J., Song, Q., Qin, Y.T. and Liang, J.F. (2016) Computer-Assisted Virtual Preoperative Planning in Orthopedic Surgery for Acetabular Fractures Based on Actual Computed Tomography Data. *Computer Assisted Surgery*, **21**, 160-165. <https://doi.org/10.1080/24699322.2016.1240235>
- [33] Haeberle, H.S., Helm, J.M., Navarro, S.M., Karnuta, J.M., Schaffer, J.L., Callaghan, J.J., et al. (2019) Artificial Intelligence and Machine Learning in Lower Extremity Arthroplasty: A Review. *The Journal of Arthroplasty*, **34**, 2201-2203.  
<https://doi.org/10.1016/j.arth.2019.05.055>
- [34] Farooq, H., Deckard, E.R., Ziembra-Davis, M., Madsen, A. and Meneghini, R.M. (2020) Predictors of Patient Satisfaction Following Primary Total Knee Arthroplasty: Results from a Traditional Statistical Model and a Machine Learning Algorithm. *The Journal of Arthroplasty*, **35**, 3123-3130.  
<https://doi.org/10.1016/j.arth.2020.05.077>
- [35] Zhao, J.X., Su, X.Y., Zhao, Z., Xiao, R.X., Zhang, L.C. and Tang, P.F. (2020) Radiographic Assessment of the Cup Orientation after Total Hip Arthroplasty: A Literature Review. *Annals of Translational Medicine*, **8**, 130.  
<https://doi.org/10.21037/atm.2019.12.150>
- [36] Fan, X., Zhu, Q., Tu, P., Joskowicz, L. and Chen, X. (2023) A Review of Advances in Image-Guided Orthopedic Surgery. *Physics in Medicine & Biology*, **68**, 02TR01.  
<https://doi.org/10.1088/1361-6560/aca9e9>
- [37] Picard, F., Deakin, A.H., Riches, E., Deep, K. and Baines, J. (2019) Computer Assisted Orthopaedic Surgery: Past, Present and Future. *Medical Engineering & Physics*, **72**, 55-65. <https://doi.org/10.1016/j.medengphy.2019.08.005>
- [38] Jayakumar, P., Moore, M.L. and Bozic, K.J. (2019) Value-Based Healthcare: Can Artificial Intelligence Provide Value in Orthopaedic Surgery? *Clinical Orthopaedics and Related Research*, **477**, 1777-1780.  
<https://doi.org/10.1097/CORR.0000000000000873>

- [39] Loppini, M., Gambaro, F.M., Chiappetta, K., Grappiolo, G., Bianchi, A.M. and Corino, V.D.A. (2022) Automatic Identification of Failure in Hip Replacement: An Artificial Intelligence Approach. *Bioengineering (Basel)*, **9**, Article 288. <https://doi.org/10.3390/bioengineering9070288>
- [40] Klemm, C., Yeo, I., Harvey, M., Burns, J.C., Melnic, C., Uzosike, A.C. and Kwon, Y.M. (2023) The Use of Artificial Intelligence for the Prediction of Periprosthetic Joint Infection Following Aseptic Revision Total Knee Arthroplasty. *The Journal of Knee Surgery*. <https://doi.org/10.1055/s-0043-1761259>
- [41] Rouzrokh, P., Ramazanian, T., Wyles, C.C., Philbrick, K.A., Cai, J.C., Taunton, M.J., Kremers, H.M., Lewallen, D.G. and Erickson, B.J. (2021) Deep Learning Artificial Intelligence Model for Assessment of Hip Dislocation Risk Following Primary Total Hip Arthroplasty from Postoperative Radiographs. *The Journal of Arthroplasty*, **36**, 2197-2203. <https://doi.org/10.1016/j.arth.2021.02.028>
- [42] Polisetty, T.S., Jain, S., Pang, M., et al. (2022) Concerns Surrounding Application of Artificial Intelligence in Hip and knee Arthroplasty. *The Bone & Joint Journal*, **104-B**, 1292-1303. <https://doi.org/10.1302/0301-620X.104B12.BJJ-2022-0922.R1>
- [43] Oosterhoff, J.H. and Doornberg, J.N. (2020) Artificial Intelligence in Orthopaedics: False Hope or Not? A Narrative Review along the Line of Gartner's Hype Cycle. *EFORT Open Reviews*, **5**, 593-603. <https://doi.org/10.1302/2058-5241.5.190092>
- [44] Wang, Y., Li, R. and Zheng, P. (2022) Progress in Clinical Application of Artificial Intelligence in Orthopedics. *Digital Medicine*, **8**, 4.