Volume **5** (2) 2023 https://doi.org/10.5204/lthj.2550

Perspectives on Database Rights of Humans and Machines in Electronic Health Records: Focus on South Africa

Ogochukwu Monye[1]
University of Benin, Nigeria; University of Cape Town, South Africa

Abstract

Database right, as a subcategory of copyright law, rewards the creative exploits, labour and skill expended in compiling, arranging and organising a set of information for ease of use. When humans create, the labour and ingenuity exerted in reaching completion is compensated by the law by bestowing exclusive rights of exploitation on creators and their assigns. In the sphere of Electronic Health Record databases, data (which are mainly inputted by clinicians) are obtained from various sources, including clinician deduction, patients and caregivers' observations and reports, and family-reported or community-reported traits. Using the doctrinal research method and writing primarily from a South African legal standpoint with insights drawn from other countries, the author considers the dynamics of navigating ownership rights in Electronic Health Record databases and the associated challenges when AI is involved. In summary, this paper examines the Electronic Health Record ownership rights of humans and machines, particularly in the South African context.

***Keywords**:* Artificial intelligence; AI; database rights; electronic health records (EHR).

1. Introduction

There is no consensus on the definition of an Electronic Health Record (EHR); however, Phaneuf defined it as 'a collection of patients' medical history including diagnoses, medications, treatment plans, allergies, laboratory and test results'.[2] It can also be described as 'an automated, paperless and online medical record for which patient medical data are entered by eligible providers, such as nurses and physicians'.[3] EHRs should not be mistaken for Electronic Medical Records (EMRs). According to Kariotis et al., while an EMR is generally considered to be a record of a person's health encounters in a specific health setting, an EHR is usually a compilation of summary information from across EMRs in a region, country or health system.[4] Examples of such EHRs include patient medical and treatment histories and patient health information, such as administrative and billing data, patient demographics, diagnoses, medications, treatment plans, progress notes, vaccination dates, allergies, radiology images and laboratory and test results.[5] An EHR could additionally include healthcare provider notes, genetic testing data and recordings from medical devices or wearable sensors.[6]

[1] PhD, Senior Law Lecturer, University of Benin, Nigeria; Researcher, South African Research Chair in Intellectual Property, Innovations and Development, Faculty of Law, University of Cape Town, South Africa. ORCID https://orcid.org/0000-0002-4548-7081. This work is based on research supported in part by the National Research Foundation (NRF) of South Africa (Grant no: 115716). Any opinion, finding and conclusion or recommendation expressed in this material is that of the author and the NRF does not accept any liability in this regard.
[2] Phaneuf, "What is an EHR system?"
[3] Techopedia, "Electronic Health Record."
[4] Kariotis, "Impact of Electronic Health Records," 3.
[5] Office of the National Coordinator for Health Information Technology (ONC), "What is an Electronic Health Record?"
[6] Jianxing, "Practical Implementation of Artificial Intelligence Technologies," 30.

On the utility of EHRs, authors have detailed significant benefits. For instance, the management of patient health data in a digital format has been acknowledged.[7] Again, EHR systems are understood to affect physician productivity and patient satisfaction by speeding up physician diagnoses, digitising administrative tasks, reducing file pulls and transcription costs, providing all-day patient access, improving billing and scheduling, enhancing disease management and delivering health education.[8] EHRs are also reported to aid 'quality, efficient, convenient and safe care, up-to-date information provision, secure data transfer, effective diagnosis, effective patient/provider interaction, streamlined documentation, coding and billing, improved productivity and work-life balance and reduced costs of paperwork and duplication'.[9] Further, these could provide an avenue for the 'seamless information flow within the digital ecosystem, improved patient care, coordination and participation and enhanced diagnostics and outcomes'.[10]

A networked EHR, a variant of EHRs, is designed for information sharing with multiple healthcare players such as laboratories, specialists, medical imaging facilities, pharmacies, emergency facilities and school and workplace clinics.[11] This facilitates data sharing among healthcare providers and provides evidence to each entity to appropriately determine a patient's care pathway.[12] By granting access to all the health professionals involved in the patient journey, EHRs can optimise patient care, streamline procedures and motivate patients to keep up with lifestyle changes that have positively impacted treatment.[13] This is said to 'drive better health, foster patient participation in decisions beyond passive receipt of care, encourage medication adherence and improve outcomes'.[14] Again, since EHRs offer an integrated and interoperable system that paints a comprehensive picture of a patient, benefits are reported to accrue not only to the patient but also to research and the bio-economy.[15] Unsurprisingly, longitudinal patient health data have been found to contribute to better health provision and clinical outcomes, research, planning and patient safety.[16]

However, there are some concerns regarding the use of EHRs. For instance, there are worries about the time taken to record patient information, which sometimes extends beyond work hours, negatively impacting work–life balance and exposing physicians to burnout.[17] Again, there are concerns about interoperability, as well as the risk of breaching data privacy.[18] This is because EHRs transcend one patient's health data and extend to other sources and subjects. For instance, EHRS could encompass treatment outcomes, patient-generated data, data from social media and wearable devices, smartphone applications and genomic data.[19] These broad datasets can paint a broad picture of not only one person's health but also that of their extended families and communities. This is particularly significant in relation to sensitive health data, such as behavioural health information.[20] Other concerns include content quality and accuracy, the dynamics of the doctor–patient relationship, privacy, confidentiality, informed consent, licensing and regulation.[21]

The article examines how South African jurisprudence accords EHR ownership from the perspective of database rights as a subcategory of copyright law. This paper uses the doctrinal research method and is set out as follows. The next section details the ownership of EHRs. This is followed by a delineation of database rights in South Africa, drawing some insights from other jurisdictions. Thereafter, the debate regarding the ownership of EHR databases generated by AI is outlined.

[7] Phaneuf, "What is an EHR System?" It is also common for healthcare professionals to enter patient data manually, and some EHRs are operated offline or hosted on clients' servers.
[8] Phaneuf, "What is an EHR System?"
[9] HealthIT.gov, "Frequently Asked Questions."
[10] HealthIT.gov. "Benefits of EHRs."
[11] ONC. "What are the Advantages?"
[12] Phaneuf, "What is an EHR System?"
[13] Garrett, "EMR vs EHR."
[14] Mikk, "Pathways to Patient Data Ownership," 1433.
[15] Wyatt, "Delivering Healthcare's 'Triple Aim'," 1323.
[16] Papoutsi, "Patient and Public Views," 12.
[17] Robertson, "Electronic Health Record Effects," 480.
[18] Phaneuf, "What is an EHR System?"
[19] Mikk, "Pathways to Patient Data Ownership," 1433.
[20] Techopedia, "Electronic Health Record."
[21] Townsend, "E-Health, Social Media and the Law," 36.

2. Who Owns EHRs?

The global market size for EHRs was USD 29,417.2 million in 2021 and is projected to reach USD 42,203.5 million by 2028.[22] Therefore, it is not surprising that ownership of EHR data is contended by a host of actors including patients, government, trusts, medical teams, drug companies and bio banks.[23] It is still unclear in many jurisdictions whether clinical data can be legally or quasi-legally classed as private property from which a right to transact in arises.[24] Further, the ownership of patients' health data remains broad and could cut across several fields of law including intellectual property (IP), labour law, property, data privacy and contract—which could create uncertainty about rights and obligations. (To retain focus on the objectives of this article, only ownership relating to IP rights—namely, database rights—is considered). Significantly, there is a clear distinction between EHR data, the databases that EHRs are comprised of (i.e., the source works) and AI (i.e., the computer programs). The first is discussed in this section, the next in Section 4, and Section 5 focuses on computer-generated works.

Determining the existence of a right in EHRs, as well as its ownership, is necessary to clarify the limits of rights and the accrual of benefits. This could involve breaking comprehensive EHR data into subsets to determine each actor's contribution and quantify compensation, whether in money's worth or associated benefits. Consideration will also be given to the varying value emplaced on each dataset, depending on perspectives of personal and clinical value. For example, seemingly trivial data (to the average patient) such as weight and height could, in contrast, prove to be of immense significance to a clinician's diagnoses of risk factors or health conditions (e.g., diabetes or heart disease) and aid future predictions.[25]

Another consideration in determining ownership is the unique nature of EHR data, which result from varied sources. Notably, clinicians contribute immensely to the population of data on EHRs. In many cases, while patients describe symptoms, the clinician's investigation through lab tests, documentation, reporting and diagnoses is also crucial and involves a significant quantity of observations, perception, interpretation, measurement, work, skill, judgement, and equipment.[26] In general, the medical team has the responsibility to 'extract, interpret, process, describe, classify and store health information including medical history, radiology images, blood samples and gene sequencing'.[27] These health professionals are responsible for inputting, organising and reporting data on diagnoses and patient monitoring; additionally, they invest time, effort and money in organising and managing data.

Therefore, in accordance with the philosophy that whoever bears the cost of continuous data processing that sustains data availability should be compensated for the cost of maintenance, some favour clinician rights to EHRs.[28] In line with clinicians' rights to EHRs, authors have noted that this could stave off free-riding and serves as a form of reward for clinicians and funders for the effort, time and money expended in creating and maintaining these data.[29] However, not everyone agrees with this notion.

The above philosophy does not find favour in jurisdictions such as Britain, Australia, Singapore and New Zealand, which have government-sponsored national health systems. It is argued that clinicians that create health data during treatment are paid by the state with funding from taxpayers.[30] Accordingly, supporting clinicians' rights could usher in exclusion and lock-in and discourage data portability as this could ascribe to clinicians the power to bar patients from transferring their data to other healthcare providers and pharmaceuticals, thereby resulting in patients' locking-in. Clinicians' additional contributions to disease diagnosis and observations of treatment progression could be used to prevent patients from accessing their health data freely.

However, the question of rights in EHR databases cannot be complete without acknowledging the value of patients' contributions. It is notable that patients and their caregivers contribute to the data recorded in EHRs by reporting symptoms. In addition, patients and their caregivers report observable treatment progression and drug interactions to the medical team. Some of these data come from their wearable accessories, such as smart watches, smart bracelets, armbands and glasses; they report

[22] Zion Market Research, "Global Demand of Electronic Health Records." However, this market size refers to the systems or software and not necessarily to the value of the data contained.
[23] Liddell, "Patient Data Ownership," 3.
[24] Ballantyne, "How Should We Think," 290.
[25] Liddell, "Patient Data Ownership," 5.
[26] Liddell, "Patient Data Ownership," 6.
[27] Ballantyne, "How Should We Think," 292.
[28] Anane-Sarpong, "You Cannot Collect Data," 402.
[29] Anane-Sarpong, "You Cannot Collect Data," 399.
[30] Ballantyne, "How Should We Think ," 292.

this data to healthcare professionals.[31] Patients equally report patterns of recovery and information on previous diseases and family history to clinicians.[32]

All these pieces of information are possible due to patients; hence, some experts have argued that EHRs are primarily a product of patients' bodies and actions that bestows on them not only the right to control but also to make decisions about these data.[33] This is predicated on the basis that without patients, there are no data.[34] In addition, it is argued in support of this position that ascribing more rights to patients in the context of EHRs could help in the determination of value and exploitation of their data, while the opposite would ascribe the rights to 'appropriate, assert, and maintain ownership' to private companies.[35] Further, this is contended to usher in autonomy and privacy, market efficiency, equity of sharing in the proceeds of health data, clarity about the use of data by all actors and encouragement of investment in health data–driven innovation.[36]

However, this line of reasoning is also not without contest; opponents of this school of thought assert that patients cannot lay claim to any transactional rights in EHRs, having already attained benefits from the records during the care journey.[37] Writing on the delineation of data as property, Liddell alluded to this as potentially opening the door to 'an unending series of toll booths'.[38] Thus, patients could become suppliers of EHRs to private entities, research institutions and pharmaceutical companies, not to mention the difficulty of determining how to break down and sell pieces of these records to interested parties and emplace value for varied purposes. It is difficult to imagine how this could become the norm considering the amount of energy and scrutiny needed to separate information contained in EHRs and to determine what is of importance to each party as well as the evaluation of compensation.

Further, beyond these direct contributions from clinicians and patients, there are also third-party and external players and sources of data that prove useful in compiling EHRs. Evidently, patient data could be reported and sourced from family medical history and shared health and genetic data, as well as publicly available data and those obtained from patient reports and clinicians' deductions.[39] These could contain relevant medical history that identifies prevalent physiological and behavioural traits. The social media pages of patients or their networks are another source for generating EHRs, particularly if AI is employed.

In view of this wide array of data sources for EHRs, defining ownership presents challenges such as the varying claims of each party and the extent of rights pertaining to access and use, as well as attendant priority interests.[40] It could therefore be unfair to ascribe ownership to any one party where all contributors are crucial in piecing together an intelligible picture of the patient's health. One must also consider the store placed on each dataset, which, again, is dependent on perspectives that are altogether crucial. The next section considers database law in South Africa; it details the extent of rights that accrue to a person who makes investments in terms of money, time and energy to organise and manage a database.

3. Database Law in South Africa

Section 2(1) of the *South African Copyright Act 98 of 1978* lists works eligible for copyright as literary works, musical works, artistic works, cinematograph films, sound recordings, broadcasts, program-carrying signals, published editions and computer programs. Specifically, eligible literary works include novels, stories and poetic works, dramatic works, stage directions, cinematographs, film scenarios and broadcasting scripts, textbooks, treatises, histories, biographies, essays and articles, encyclopedias and dictionaries, letters, reports and memorandums, lectures, addresses and sermons and written tables and compilations.[41] The reference to tables or compilations encompasses databases to which copyright accrues whether embodied in a computer or a medium used in conjunction with a computer.[42]

[31] Lu, "Wearable Health Devices ," 3.
[32] Petersen, "Legal and Regulatory Considerations," 17.
[33] Ballantyne, "How Should We Think," 292.
[34] Liddell, "Patient Data Ownership," 6.
[35] Liddell, "Patient Data Ownership" 43.
[36] Liddell, "Patient Data Ownership," 35.
[37] Ballantyne, "How Should We Think," 292.
[38] Liddell, "Patient Data Ownership," 40.
[39] Liddell, "Patient Data Ownership," 7.
[40] Ballantyne, "How Should We Think," 294.
[41] *South Africa Copyright Act 98 of 1978*, s 1.
[42] *South Africa Copyright Act 98 of 1978*, s 1.

These databases could also be electronic or hardcopy, including EHRs. Where literary works including databases are made by or under the direction or control of the state, copyright shall reside in the government.[43] The issue of whether an EHR is its own database or a compilation of databases is also noteworthy. The Copyright Act protects databases, also known as compilations, as literary works while computer programs enjoy protection not as literary works but as computer programs. This classification as computer programs is quite unique to South Africa.

In a number of judicial pronouncements, the courts in South Africa have accepted a wide range of compilations to qualify for protection as databases. In *Fax Directories (Pty) Ltd v SA Fax Listings*, a directory of telefax users was accepted by the court to be eligible for copyright protection.[44] Similarly, in *Payen Components SA Ltd. v Bovic CC & others*, a catalogue and price list were equally accorded protection as a database by the court regarding a numbering system identifying a range of gaskets in use in South Africa.[45] The court in *Bosal Africa (Pty) Ltd v Grapnel (Pty) Ltd & another* also upheld a claim for breach of copyright in relation to a part numbering code compiled in the plaintiff's price list and catalogue.[46] With regard to copyright protected compilations that could be incorporated into EHRs, in *Board of Healthcare Funders v Discovery Health*, the court was called upon to determine the infringement of the copyright of the applicant in the Practice Code Numbering System, which was used, published and adapted without written consent.[47] The court held in favour of the applicant that a compilation was a literary work expressed in print or writing irrespective of whether it has any excellence of quality or style of writing.

An author of literary works as defined by section 1(1) (a) is one who first makes or creates the work while, by the provisions of section 1(1)) (h), the author of a computer program is that who exercised control over the making of the computer program, defined as a set of instructions fixed or stored in any manner and that, when used directly or indirectly in a computer, directs its operation to bring about a result. First ownership of databases as literary works will vest in an author and joint authorship, in co-authors of the work according to section 21(1) (a) of the Copyright Act. Copyright in a computer program vests the exclusive right to do or authorise reproduction, publishing performing, broadcasting, causing the transmission of the computer program, adapting, letting, or offering or exposing for hire by way of trade, directly or indirectly, a copy of the computer program.[48] However, exceptions exist for works commissioned and those made in the course of employment or under a contract of service or apprenticeship. In these situations, copyright vests in the employer.[49]

For copyright protection to accrue in literary works (including databases), it has to be shown that 'sufficient effort or skill has been expended in making the work to give it a new and original character'.[50] The Act grants rights of exploitation to authors of literary works irrespective of literary quality and mode of expression.[51] This principle enjoys judicial backing in a number of cases where the courts have toed this line of reasoning. The court in *Klep Valves (Pty) Ltd v Saunders Valve Company Ltd* stated that originality could be proved by evincing that the work in question emanated from the author and was not copied.[52] Similarly, the court in *Board of Healthcare Funders v Discovery Health* discussed supra held that originality does not demand original or inventive work but only that the work should not be copied and should originate from the author and the sum total of the compilation may be original. In this case, the years of effort or skill expended in the development of the system were enough to warrant protection. In *Moneyweb v Media24*, the court held that mere slavish copying of existing works did not satisfy the standard of originality in view of the absence of the application of the author's mind.[53]

Section 2(3) of the Copyright Act does not consider works to be ineligible for copyright because prior works are infringed. The section provides that 'a work shall not be ineligible for copyright by reason only that the making of the work, or the doing of any act in relation to the work, involved an infringement of copyright in some other work'. As shown in the preceding paragraph, works are accorded originality despite containing infringing materials. Improvement or refinement of works is also eligible for copyright protection, irrespective of the fact that the improved work made use of infringing copyright in another work, as long as the alteration to the original work is substantial.[54]

[43] *South Africa Copyright Act 98 of 1978*, s 5.
[44] *Fax Directories (Pty) Ltd v SA Fax Listings CC* (1990) (2) SA 164 (D).
[45] *Payen Components SA Ltd. v Bovic CC & others* (1995) (4) SA 441 (A).
[46] *Bosal Africa (Pty) Ltd v Grapnel (Pty) Ltd & another* 1985 4 SA 482
[47] *Board of Healthcare Funders v Discovery Health* (2012) 35769/2010) ZAGPPHC 65
[48] *South Africa Copyright Act 98 of 1978*, s 11B.
[49] *South Africa Copyright Act 98 of 1978*, s 21(1) (c,d)
[50] *South Africa Copyright Act 98 of 1978*, s 1.
[51] Ibid.
[52] *Klep Valves (Pty) Ltd v Saunders Valve Company Ltd* (1986) (493/84/av) ZASCA 157.
[53] *Moneyweb v Media24* (2016) 3 All SA 193 (GJ).
[54] Ibid.

In *Haupt t/a Softcopy v Brewers Marketing Intelligence (Pty) Ltd*, the court stressed that authors had to demonstrate that works were not copied from another source and that a substantial (not trivial) degree of skill, judgement or labour was applied.[55] In other words, skill and labour (donned 'sweat of the brow') must be evidenced.[56] In the Haupt case, it was also noted by the court that the requirement for originality was satisfied as substantial degree of skill, judgement or labour was exerted in creating a converter program, which took approximately six months, and in writing the source code for a tree preparer program, which took six hours.

The foregoing show that database rights accrue to a person that has exerted time, effort, skill and judgement to create an original piece of work. This then becomes free from exploitation by others except in permissible circumstances sanctioned by the law.[57] The next section interrogates whether non-human players, notably AI, can also be ascribed database rights.

4. Does Artificial Intelligence Possess Database Rights?

AI is 'a suite of technologies, enabled by adaptive predictive power that exhibits some degree of autonomous learning to advance pattern recognition, anticipate future events, make decisions and communicate'.[58] It also refers to the ability of a digital computer or computer-controlled robot to perform tasks commonly associated with intelligent beings, including human intellectual processes and exhibiting characteristics such as the ability to reason, discover meaning, generalise or learn from past experience.[59]

In general, it acknowledged that although some machines measure up to humans in some aspects of medical diagnosis, voice or handwriting recognition, none match human flexibility in fulfilling everyday tasks despite the significant advances in computer processing speed and memory capacity.[60] Again, even though AI-based systems can solve problems and make predictions or classifications, this ability is still largely based on human input data.[61] This is because the world is still witnessing an era of 'narrow AI', which means that machines rely on human initiation, prompts or interventions to start or complete specific tasks. In this era, computing machines are not yet at the level of independently handling complex undertakings beyond programmed tasks, algorithms, rules and learning templates.[62]

The futuristic 'strong AI', also called 'artificial general intelligence' or 'super intelligence', is projected to have the capacity to fully perform intellectual tasks that are ordinarily only within the realm of humans and may surpass human intelligence.[63] The era of strong AI is expected to usher in machines that exhibit some level of sentience and complex decision-making and goal-setting abilities and could exhibit general intelligence beyond specific tasks. This era envisions machine intelligence that will equal or exceed that of humans so that machines exhibit self-aware consciousness and problem-solving skills in addition to the ability to learn and plan for the future.[64] While the full manifestation of this era is not yet known, it has been suggested that full evolution could occur by the year 2099.[65]

However, AI as we know it today has advanced in many respects. AI technology has advanced to the stage of collating information to generate creative works such as paintings, poetry, news reports and musical works.[66] There are also examples of content on various topics, such as business and financial stories, weather reports and sports results written by AI systems such as Tencent's Dreamwriter.[67]

In the health sector, advances in AI have been deployed to some systems and processes to facilitate aspects of medical care. Wearables create reports for insurers or provide guidance to enhance the user's health and wellbeing.[68] These could equally 'monitor patient vital signs and laboratory indicators and provide drug administration reminders to achieve intelligent detection

[55] *Haupt v Brewers Marketing Intelligence (Pty) Ltd* (2006) SCA 39 (RSA).
[56] *South Africa Copyright Act 98 of 1978*, s 2(3); see also Pistorius, "The IP Protection of Electronic Databases" 11.
[57] *South Africa Copyright Act 98 of 1978*, s 6.
[58] Deloitte, "New Physics of Financial Services," 5.
[59] Britannica, "Artificial Intelligence."
[60] Britannica, "Artificial Intelligence."
[61] IBM, "Cloud Education Artificial Intelligence."
[62] Tianxiang, "Sentimental Fools," 224.
[63] WIPO, "Technology Trends."
[64] Britannica, "Artificial Intelligence."
[65] Ford, "Architects of Intelligence," 528.
[66] Tianxiang, "Sentimental Fools," 220.
[67] Biermann, "Artificial Intelligence – Real Copyright?"
[68] Jacobsberg, "Whose App is it Anyway?"

and analysis of human physiological and pathological information'.[69] In addition, AI systems could aid the detection of cancers, medical imaging and speech recognition.[70] AI further aids patient triaging and screening to determine care pathways, decreases the burden on clinicians and fosters consistency, speed and reproducibility.[71] Examples include Google's DeepMind, Intel's Lumiata, Ubenwa Health's birth asphyxia detection tool and Tencent's Doctorwork.

However, current AI-powered creative processes start with, or are orchestrated at some point by, humans in the form of labelled datasets, templates, input data or staged interventions. This is because, as explained above, we still operate in the era of narrow AI. Therefore, it is significant that in the sphere of patient care, AI health data is not yet robust or externally validated and could lead to misdiagnosis by faulty algorithms, loss of jobs for professionals, lack of emotive patient care and the risk of bias and poor predictions for particular demographics without representative data.[72] AI systems could also erode clinician trial and error and meaningful patient interaction contributed by physicians and herald ethical issues in triaging where significant human expertise and experience are required.[73] There are also liability issues involved as clinicians or patients could be held legally responsible in negligence cases if an AI machine is treated as a mere 'diagnostic support tool such as a blood test without the decision-making capacity'.[74]

Of utmost concern for our purpose is the question of whether AI can, on its own, generate databases and, in turn, enjoy IP rights. Arguments vary across jurisdictions. In the first place, advances in machine learning require vast datasets to identify patterns and develop algorithms.[75] Inputs for machine learning include not only traditional data but also huge training datasets of video, audio recording, text and even software, each subject to copyright; attempting to trace and obtain permission for each is both arduous and impractical.[76] Again, one must consider whether AI can meet the eligibility standard needed to grant ownership of a database as a literary work. The answer to this is not clear-cut because eligibility is interpreted differently across jurisdictions.[77] For instance, it has been noted that in Germany, factual databases would not qualify for copyright protection unless expertise beyond that of a programmer is shown in selecting, accumulating and organising the database; in France, original works have to embody the personality of the author.[78]

Further, in some jurisdictions, while humans may be considered authors of the creative works of their machines, as controllers of the machine, other jurisdictions reject this summation. For instance, in Hong Kong, machine ownership is permitted. Here, computers can be named as owners to prevent human owners from free-riding on the works of their machines in creating the content.[79] However, this has been argued by some authors to usher in detriments. For instance, Tianxiang asserted that AI systems mostly arrive at definite results when set on the same objective and, therefore, cannot achieve the standard of originality.[80] The author also argued that, consequently, machine attribution could not only usher in a multiplicity of claims for AI systems but also make humans redundant in the future.[81]

In contrast, China grants authorship of AI-generated content solely to natural or legal persons.[82] The *Copyright Law of China 1990* provides that the copyright belongs to the person that creates a work in the case of a citizen or, in the case of a legal entity, one according to whose intention or under whose supervision and responsibility the work was created.[83] No machine authorship or ownership is permitted here. Proponents maintain that the data fed in by humans to instruct the machine and expose it to learning should be acknowledged as sufficient labour to meet the standard of protection.[84] In support of this stance, authors have maintained that to create, machines must be exposed to a field of knowledge and then activated to generate ideas that are innovative and useful—and that incentivising inventors through rewards and attribution encourages innovation.[85]

[69] Lu, "Wearable Health Devices," 3.
[70] Davenport, "Potential for Artificial Intelligence," 94.
[71] Jianxing, "Practical Implementation," 30.
[72] Morley, "Ethics of AI in Healthcare," 5.
[73] Morley, "Ethics of AI in Healthcare," 5.
[74] Morley, "The Ethics of AI," 7.
[75] Rens, "Copyright Flexibility," 2019.
[76] Rens, "Copyright Flexibility," 2019.
[77] Pistorius, "IP Protection of Electronic Databases," 3.
[78] Pistorius, "IP Protection of Electronic Databases," 3.
[79] *Copyright Ordinance of Hong Kong 2019*, s 178.
[80] Tianxiang, "Sentimental Fools," 234.
[81] Tianxiang, "Sentimental Fools," 234.
[82] *Copyright Law of China 1990*, 2.
[83] *Copyright Law of China 1990*, 11.
[84] Ballantyne, "How Should We Think," 292.
[85] Kovach, "Ostrich With Its Head," 149.

In the Chinese case of *Shenzhen Tencent v Shanghai Yingxun*, the court held that the reprint of a news story written independently by an AI writer without permission was an infringement.[86] Commenting on this case, Zhou noted that the court recognised that the plaintiff and members of the creative team exhibited intellectual endeavour in the 'arrangement and selection of data input, trigger condition setting, template and corpus style choices and the article's presentation and that AI did not work independently but rather assisted the team'.[87] In adopting the definition of AI as 'machines and systems that can perform tasks considered to require human intelligence with limited or no human intervention', Zhou also asserted that ascribing the creation of works to AI would require excluding the machine or system generating process undertaken by humans.[88] According to the author, this would mean that there can never be true autonomous AI creation except in cases involving machine and deep learning capabilities, where new algorithms could be generated independently by AI.[89]

In South Africa, our focus country, the copyright principle that, unlike patents, works need not be new to enjoy copyright protection holds through. In other words, similar or identical works can enjoy copyright if shown to have been independently created. Here, authorship is granted to the owner of the machine if it can be shown that the work was the result of an owner's effort and expertise, including the exercise of a degree of judgement, selection, skill and effort.[90] As provided in section 1 of the Copyright Act, the owner of a computer-generated work is 'the person by whom the arrangements necessary for the creation of the work were undertaken'. Merely owning the AI system is not enough as arrangements must have been shown to be made by one claiming ownership in the creation of the work. This owner must have exerted control of the creative process.

In *Bergh and Others v the Agricultural Research Council*, the agreement by an employee software developer to create a dairy farmers' program and, in the absence of finance to retain the copyright therein, was acceptable to vest ownership.[91] It is noteworthy that in this case that Mr Pauw was commissioned by the research council to write the BeefPro program; thus, he was not an employee but rather commissioned. As such, this distinction is crucial because while the South African Copyright Act permits commissioning exception in section 21(1) (c) in relation to photos, portraits, gravures, cinematograph films and sound recordings, this is not applicable to databases or computer programs. However, the employment exception provided in section 21(1) (d) applies to all types of work.

The court also made detailed and significant pronouncements on the position in South Africa with regard to databases in the case of *Haupt v Brewers Marketing Intelligence (Pty) Ltd*. Here, the appellant, Anton Haupt, applied for an order interdicting the respondents from copyright infringement in a computer program known as Data Explorer and also in certain tables (or database structures) and databases.[92] The court emphasised that 'it is necessary to first determine whether the works we are concerned with are literary works, computer programs, computer-generated literary works or computer-generated computer programs and to then determine whether they are original and finally, the author of the relevant work'. An author is one that first makes or creates the work in the case of a literary work; a person who exercises control over the making of the computer program in the case of a computer program; and, in the case of any of these works having a computer-generated 'author', the person by whom the arrangements necessary for the creation of the work were undertaken.

The court went further to distinguish between computer-generated works that are made without human intervention and computer-assisted ones where humans are involved. Accordingly, the Data Explorer program (that comprises search and graph instructions), the converter program and the tree preparer program were classified by the court as computer programs due to the embedded code bearing a set of instructions that, when used in a computer, directs its operation to bring about a result. However, the court classified the database structures comprising a table with a number of varying columns as a literary work rather than a computer program as this did not consist of a set of instructions.

On the significance of improvements made to existing works, the court also agreed with the appellant that the writing of the source code for the search and the graph instructions incorporated as a function for the Data Explorer program was a significant improvement. According to the court, the fact that Haupt and the respondents considered it necessary for the Data Explorer and Brewer's All Media Products Survey (AMPS) programs was enough evidence of significant improvement.
In considering works made in the course of employment, the court drew a distinction between 'control', in the definition of 'author' in respect of a computer program, and 'control' by virtue of a contract of employment. The court explained that the

[86] *Shenzhen Tencent v Shanghai Yingxun* (2019) Yue 0305 Min Chu 14010.
[87] Bo, "Artificial Intelligence and Copyright Protection," 2.
[88] Bo, "Artificial Intelligence and Copyright Protection," 3.
[89] Bo, "Artificial Intelligence and Copyright Protection," 3.
[90] Biermann, "Artificial Intelligence – Real Copyright?"
[91] *k Agricultural Research Council (ARC) (Bergh and Others v The Agricultural Research Council* (2020) (Case no 93/2019) ZASCA 30 *Bergh and Others v The Agricultural Research Council* (2020) (Case no 93/2019) ZASCA 30
[92] *Haupt v Brewers Marketing Intelligence (Pty) Ltd* SCA 39 (RSA).

word ‘control’ in the former context has a wider meaning than ‘control’ in the employment arrangement. In this case, Haupt was said to have instructed Coetzee (the writer of the computer program) about the intended end result, demanded improvements as the work progressed, constantly communicated about the details of the work, and oversaw and approved periodic submission of aspects of the work. Here, the court held that control transcended merely providing functional requirements and reviewing the program drafts periodically.

In its judgement, the court therefore held that copyright in the Data Explorer program, including the search and graph instructions, converter and the tree preparer program, vested in Haupt, having been in a position of authority over Coetzee in the writing of the computer program. Although Haupt did not make or create the databases and database structures, the court found that there was sufficient exercise of control over the work of Coetzee (the software developer) by contacting, instructing, checking and approving the final computer program.

From the foregoing, it can be deduced that the issue of control is central to the determination of the authorship rule for computer programs in South Africa. This is different from first copyright ownership as a general rule, with the exception of situations where the author is also the first copyright owner. Therefore, for our purpose, copyright in works generated by AI will vest in one who has made arrangements for the creation of the work—in view of the fact that making arrangements for AI training datasets and system setup could involve an array of actors including software and program developers and coders, data analysts and writers, AI data trainers and testers, research scientists, software and AI engineers, and big data managers and aggregators. Oriakhogba has suggested vesting ownership in such scenarios in the AI developer that made the arrangement for the work.[93] This should usually be that who brought together the collaborators and arranged for each actor’s role, playing an overarching organisation role.

5. Conclusion

South Africa awaits the introduction of the *Copyright Amendment Bill of 2017*, which makes provisions for works created by AI and is expected to expand fair use and enable more innovative and non-infringing utilisation of data within the limits of the law. The substantive *Copyright Act 98 of 1978* vests copyright in respect of a computer-generated work in a person that has made arrangements for the creation of the work. This unique position could incentivise innovations in the development of AI use applications for EHRs. Already, these are proving to be an important resource for patient care that can be impactful not only to patients and clinicians but also equally to other actors in the ecosystem of the patient care journey as well as to research and public health.

Acknowledgments
This work was carried out under the auspices of the SARChI Chair: Intellectual Property Innovation and Development, University of Cape Town. Funding from the Chair is hereby acknowledged.

[93] Oriakhogba, “Fair Use.”

Bibliography

Anane-Sarpong, Evelyn, Tenzin Wangmo, Claire Leonie Ward, Osman Sankoh, Marcel Tanner and Bernice Simone Elger. "You cannot collect data using your own resources and put it on open access: Perspectives from Africa about public health data- sharing." *Developing World Bioethics* 18 (2018): 394–405. https://doi.org/10.1111/dewb.12159.

Ballantyne, Angela. "How Should We Think About Clinical Data Ownership?" *Journal of Medical Ethics* 46 (2020): 289–294. http://dx.doi.org/10.1136/medethics-2018-105340.

British Broadcasting Corporation. "DeepMind Faces Legal Action over NHS Data Use" October 1, 2021. https://www.bbc.com/news/technology-58761324.

Biermann, Hugo. "Artificial Intelligence – Real Copyright?" April 6, 2020. https://www.ensafrica.com/news/detail/2447/artificial-intelligence-real-copyright.

Bo, Zhou. "Artificial Intelligence and Copyright Protection – Judicial Practice in Chinese Courts". https://www.wipo.int/export/sites/www/about-ip/en/artificial_intelligence/conversation_ip_ai/pdf/ms_china_1_en.pdf.

Britannica. "Artificial Intelligence." 2022. https://www.britannica.com/technology/artificial-intelligence/Alan-Turing-and-the-beginning-of-AI.

Davenport, Thomas and Ravi Kalakota. "The Potential for Artificial Intelligence in Healthcare", *Future Healthcare Journal* 6, no 2 (2019): 94–98. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6616181/pdf/futurehealth-6-2-94.pdf.

Deloitte. "The New Physics of Financial Services: How Artificial Intelligence is Transforming the Financial Ecosystem." 2018. Touche Tohmatsu Limited, https://www2.deloitte.com/content/dam/Deloitte/uk/Documents/financial-services/deloitte-uk-world-economic-forum-artificial-intelligence-summary-report.pdf

Ford, Martin. *Architects of Intelligence: The Truth About AI From the People Building It*. Packt Publishing, 2018.

Garrett, Peter and Joshua Seidman. "EMR vs EHR – What is the Difference?" January 4, 2011. https://www.healthit.gov/buzz-blog/electronic-health-and-medical-records/emr-vs-ehr-difference.

HealthIT.gov. "Benefits of EHRs." 2022. https://www.healthit.gov/topic/health-it-and-health-information-exchange-basics/benefits-ehrs.

HealthIT.gov. "Frequently Asked Questions Advantages of Electronic Health Records." 2022. https://www.healthit.gov/faq/what-are-advantages-electronic-health-records.

Henne, Kate, Renee Shelby and Jenna Harb. "The Datafication of #MeToo: Whiteness, Racial Capitalism, and Anti-Violence Technologies." *Big Data & Society* 8, no 2 (2021): 1–14. https://journals.sagepub.com/doi/full/10.1177/20539517211055898.

Hub of All Things. "Own Your Personal Data Server and Private AI." 2022. https://www.hubofallthings.com/.

IBM. "Cloud Education Artificial Intelligence." 2020. https://www.ibm.com/cloud/learn/what-is-artificial-intelligence.

Jacobsberg, Ian and Alude Xuba. Whose App is it Anyway? Ownership of Copyright in Computer-Generated Materials. May 13, 2020. https://www.tabacks.com/news-and-insights/2020/5/whose-app-is-it-anyway-ownership-of-copyright-in-computer-generated-materials.

Jianxing, He, Sally L Baxter, Jie Xu, Jiming Xu, Xingtao Zhou and KangZhang. "The Practical Implementation of Artificial Intelligence Technologies in Medicine." *Nature Medicine* 25, no 1 (2019): 30–36. https://doi.org/10.1038/s41591-018-0307-0.

Kariotis, Timothy C, Megan Prictor, Shanton Chang and Kathleen Grey. "Impact of Electronic Health Records on Information Practices in Mental Health Contexts: Scoping Review." *Journal of Medical Internet Research* 24, no 5(2022): e30405. https://doi.org/10.2196/30405.

Kovach, Ben. "Ostrich with Its Head in the Sand: The Law, Inventorship, & Artificial Intelligence.". *Journal of Technology and Intellectual Property* 19, no 1 (2021): 137–153.

Liddell, Kathleen, David A Simon and Anneke Lucassen. "Patient Data Ownership: Who Owns Your Health?" *Journal of Law and the Biosciences* 8, no 2 (2021): 1–50. https://doi.org/10.1093/jlb/lsab023.

Lu, Lin, Jiayao Zhang, Yi Xie, Fei Gao, Song Xu, Xinghuo Wu and Zhewei Ye. "Wearable Health Devices in Health Care: Narrative Systematic Review." *Journal of Medical Internet Research Mhealth Uhealth* 8, no 11 (2020): e18907. https://doi.org/10.2196/18907.

Mikk, Katherine A, Harry A Sleeper and Eric J Topol. "The Pathways to Patient Data Ownership and Better Health." *JAMA* 318, no 15 (2017): 1433–1434. Doi: 10.1001/jama.2017.12145.

Morley, Jessica, Caio CV Machado, Christopher Burr, Josh Cowls, Indra Joshi, Mariarosaria Taddeo and Luciano Floridia "The Ethics of AI in Healthcare: A Mapping Review." *Social Science & Medicine Elsevier* 260 (2020): 113172. https://doi.org/10.1016/j.socscimed.2020.113172.

Office of the National Coordinator for Health Information Technology. "What is an Electronic Health Record (EHR)?" 2022 https://www.healthit.gov/faq/what-electronic-health-record-ehr.

Office of the National Coordinator for Health Information Technology. "What are the Advantages of Electronic Health Eecords?" 2022. https://www.healthit.gov/faq/what-are-advantages-electronic-health-records.

Oriakhogba, Desmond. "Fair Use, AI Author and Inventor Take Centre Stage at the Industry 4.0 and Intellectual Property Colloquium." October 28, 2019 http://www.ipchair.uct.ac.za/news/fair-use-ai-author-and-inventor-take-centre-stage-industry-4o-and-intellectual-property.

Papoutsi, Chrysanthi, Julie E Reed, Cicely Marston, Ruth Lewis, Azeem Majeed and Derek Bell. "Patient and Public Views About the Security and Privacy of Electronic Health Records (EHRs) in the UK: Results from a Mixed Methods Study." *BMC Medical Informatics and Decision Making* 15, no 86 (2015): 1–15. https://doi.org/10.1186/s12911-015-0202-2.

Petersen, Carolyn and Paul R DeMuro. "Legal and Regulatory Considerations Associated with Use of Patient-Generated Health Data from Social Media and Mobile Health (mHealth) Devices" *Applied Clinical Informatics* 6, (2015): 16–26. http://dx.doi.org/10.4338/ACI-2014-09-R-0082.

Phaneuf, Alicia. "What is an EHR System? Definitions, Benefits, Problems and Trends for Electronic Health Records." *Insider*, May 22, 2020. https://www.businessinsider.com/electronic-health-records-benefits-challenges?r=US&IR=T.

Pistorius, Tana. "The IP Protection of Electronic Databases: Copyright or Copywrong?" Proceedings of the ISSA 2008 Innovative Minds Conference, ISSA 2008, Gauteng Region (Johannesburg), South Africa, 2008. https://digifors.cs.up.ac.za/issa/2008/Proceedings/Full/66.pdf.

Plessis, Gerard D. "South Africa: Liberty Group Wins against Discovery Vitality and Opens the Door for Comparative Advertising." *Mondaq*, June 30, 2020. https://www.mondaq.com/southafrica/trademark/959806/liberty-group-wins-against-discovery-vitality-and-opens-the-door-for-comparative-advertising.

Rens, Andrew. "Copyright Flexibility Opens the Door to Decisive AI Advantages." *BusinessDay*, October 15, 2019. https://infojustice.org/archives/41648.

Robertson, Sandy L, Mark D Robinson and Alfred Reid. "Electronic Health Record Effects on Work-Life Balance and Burnout Within the I^3 Population Collaborative." *Journal of Graduate Medical Education* 9, no 4 (2017): 479–484. https://doi.org/10.4300/jgme-d-16-00123.1.

Savvy Cooperative. "Ask Patients." https://www.savvy.coop/.

Steyn, Waldo. "Control and Computer Programs – Who Owns the Copyright?" *ENSight*, April 7, 2020. https://www.ensafrica.com/news/detail/2458/control-and-computer-programs-who-owns-the-co?utm_source=Mondaq&utm_medium=syndication&utm_campaign=LinkedIn-integration.

Techopedia. "Electronic Health Record (EHR): What Does Electronic Health Record Mean?" 2016. https://www.techopedia.com/definition/15337/electronic-health-record-ehr.

Techopedia. "Electronic Health Record (EHR) Definition." 2016. https://www.techopedia.com/definition/15337/electronic-health-record-ehr.

Tianxiang, He. "The Sentimental Fools and the Fictitious Authors: Rethinking the Copyright Issues of AI-Generated Contents in China." *Asia Pacific Law Review* 27, no 2 (2019): 218–238. https://doi.org/10.1080/10192557.2019.1703520.

Townsend, Beverly A. "E-health, Social Media and the Law in South Africa: Can Ethical Concerns in E-Health Practice be Addressed Through Regulation?" University of Cape Town, 2013. https://open.uct.ac.za/bitstream/handle/11427/4741/thesis_law_2013_townsend_ba%20%281%29.pdf?sequence=1&isAllowed=y.

Twachtman, Gregory. "Patient Ownership of Data Might Solve Health IT Woes." *Clinical Psychiatry News* 43, no 4 (2015). https://go.gale.com/ps/i.do?p=AONE&u=unict&id=GALE|A414005285&v=2.1&it=r&sid=bookmark-AONE&asid=6bd8441a.

WIPO. "Technology Trends: Artificial Intelligence." 2019, https://www.wipo.int/edocs/pubdocs/en/wipo_pub_1055.pdf.

Wyatt, David, Scott Lampon and Christopher McKevitt. "Delivering Healthcare's 'Triple Aim': Electronic Health Records and the Health Research Participant in the UK National Health Service." *Sociology of Health & Illness* 42, no 6 (2020): 1312–1327. https://doi.org/10.1111/1467-9566.13101.

Zion Market Research. "Global Demand of Electronic Health Records (EHR) Market Size & Share to Grow at a CAGR of 6.2%, Expected to Hit USD 42,203.5 Million Mark by 2028 | EHR Industry Trends, Analysis & Forecast Report." May 16, 2022. https://www.prnewswire.com/news-releases/global-demand-of-electronic-health-records-ehr-market-size--share-to-grow-at-a-cagr-of-6-2-expected-to-hit-usd-42-203-5-million-mark-by-2028--ehr-industry-trends-analysis--forecast-report-by-zion-market-research-301548060.html#:~:text=NEW%20YORK%2C%20May%2016%2C%202022,6.2%20percent%20over%20the%20forecast.

Legislation

Copyright Law of China 1990
Copyright Ordinance of Hong Kong 2019
South African Copyright Act 98 of 1978

Case Law

Agricultural Research Council (ARC) (Bergh and Others v The Agricultural Research Council (2020) (Case no 93/2019) ZASCA 30
Bosal Africa (Pty) Ltd v Grapnel (Pty) Ltd & another (1985) 4 SA 482
Board of Healthcare Funders v Discovery Health (2012) 35769/2010) ZAGPPHC 65
Fax Directories (Pty) Ltd v SA Fax Listings CC (1990) (2) SA 164 (D).
Haupt v Brewers Marketing Intelligence (Pty) Ltd (2006) SCA 39 (RSA).
Klep Valves (Pty) Ltd v Saunders Valve Company Ltd (1986) (493/84/av) ZASCA 157
Moneyweb v Media24 (2016) 3 All SA 193 (GJ).
Payen Components SA Ltd. v Bovic CC & others (1995) (4) SA 441 (A)
Shenzhen Tencent v. Shanghai Yingxun (2019) Yue 0305 Min Chu 14010