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Innovations in Ukrainian medicine: priorities, directions, and forecasts

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Abstract

Aims: There is a tangible informative lack in terms of medical innovation in Ukraine. Little accessible information regarding the steps being taken to foster medical innovation in Ukraine is due to the country's ongoing conflict and the significant pressure on its healthcare sector. Such an informative gap emphasises the necessity for additional research into Ukraine's unique medical landscape.

Study design: Literature review

Methodology: MEDLINE, Cochrane Reviews, and Pedro were among the databases used to conduct the literature search. The conjunctions "AND" and "OR" were used with certain keywords. The articles' time range was restricted between 2018 and 2022 in order to evaluate only present recent facts. Papers discussing innovative medicine, their development, distribution or procurement were included in the inclusion criteria.

Results: Most studies examined how could be achieved the access to revolutionary medicine ignoring the medicine development. The creation of innovative medications was the subject of just one study. Most of the research discussed HTA and MEA and how important they were to ensuring patients had easy access to cutting-edge medications. Legislative or economic restrictions were the only one's present.

Conclusion: It is unclear how innovative pharmaceutical development is currently progressing in Ukraine. Health Technology Assessment (HTA) and Managed Entry Agreements (MEA) are being used to improve the access to innovative medicine in Ukraine. Buying medications for chronic illnesses is simple and convenient. In order to develop and distribute new medicine in Ukraine, regulatory and economic restrictions must be removed.

Scientific Novelty: This study is the first to analyse the availability or development of innovative medication, therefore it can serve as the foundation for future studies by other groups. However, it would necessitate further on-the-ground research concerning the actual situation surrounding the creation, dissemination, and acquisition of innovative medicines. The ongoing war effort may hinder this.

Keywords: advanced medicine; Ukraine; development; pharmaceuticals; HTA; MEA

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Introduction

Background

Innovative medicine refers to new or improved solutions with the transformative ability to accelerate a positive health impact. Examples of innovative medicine include digital health, big data, artificial intelligence, and other technologies that are fuelling a wave of health innovations around the world [1, 2]. Due to the rising need for a better healthcare and the quickening speed of technological development, there is an increasing need for the development of innovative medicine today, primarily to enhance healthcare for the patients as it is their right [3]. By offering original or better solutions, innovative medicine could hasten the health improvement. The creation of new technologies like digital health, big data, artificial intelligence, and other technologies that are catalysing a wave of health advances globally are some steps taken to achieve this. By utilising this technology, healthcare delivery may be done more effectively while also being more individualised and precise. However, there are also constraints encountered in the search for novel medical treatments. These include difficulties like data fragmentation, exorbitant prices, and uncertainty regarding data ownership.

Thus, it is pertinent to understand Ukraine's status as far as innovative medicine is concerned. This means finding out what new advancements are made in not only developing and distributing drugs, but also the amount of fundamental research that is being carried. While the war has hampered efforts in this regard, at the same time it has brought a stimulus for healthcare providers and scientists to find new ways in order to reach and treat patients, especially those who are victims of war crimes.

Unfortunately, information concerning the level of medical innovation in Ukraine now is lacking. There is little information accessible regarding the steps being taken to foster medical innovation in Ukraine, despite the country's protracted conflict and the significant burden on its healthcare sector. This knowledge gap emphasises the necessity for more research on Ukraine's unique medical landscape and the steps being taken to solve the system's problems. Thus, the goal of this evaluation of the literature is to locate and evaluate the material that is currently accessible on innovative medicine that is either already available or actively being produced in Ukraine.

Literature Review

Ukraine is still in infancy when it comes to implementing innovative medicine, but it has made recent progresses in pushing innovation despite the obstacles it faces which include a struggling economy already compounded by the ongoing war [4]. That said, a lot of the ground realities are not being fully uncovered and there is a dearth of information on the number and quality of innovation being conducted in the field of medicine.

Regarding the subtypes of innovative medicine, Ukraine has at least earnestly attempted to delve into each one. The Ukrainian healthcare system is re-organised to digital health, which refers to the use of digital technologies to improve health and healthcare. In order to improve the effectiveness of healthcare delivery and make medicine more individualised and accurate, it incorporates digital care programs and technology with health, healthcare, life, and society [5]. Technologies used in digital health include hardware and software products and services, as well as telemedicine, wearable technology, augmented reality, and virtual reality.

Another one is big data which refers to a big collection of structured and unstructured data that is analysed to discover patterns, trends, and insights. Personal health records (PHRs), electronic medical records (EMRs), electronic health records (EHRs), and data created by widely used digital health tools like wearable medical devices and mobile health apps are some of the sources of big data in the healthcare industry [6]. Ukraine has had a small success with establishing the aforementioned [7–9]. The use of big data is crucial as it allows analysis that can be used to inform decisions, enhance patient outcomes, and lower healthcare expenses.

The use of machine-learning algorithms and software to simulate human cognition in the analysis, presentation, and understanding of intricate medical and healthcare data is known as artificial intelligence (AI) in the healthcare industry [10]. Artificial intelligence programs are used in areas including medication research, personalised medicine, patient monitoring, and diagnostics. Even though other countries have made strides in the development of AI, Ukraine is still trailing behind, mostly due to legal obstacles [11], but has been open minded to include its application into medicine and other non-medical fields [12,13]. As far as untapped areas of innovative medicine are concerned, AI remains the most unexploited.

It is important to note that Ukraine's healthcare system has been under severe pressure due to the ongoing conflict in the country [14]. Due to the war's effects on the country's infrastructure and availability to care, the healthcare system has especially encountered difficulties [15]. While the healthcare system in Ukraine is still strong overall, a recent health needs assessment has found that access to essential services is becoming more difficult for a growing number of civilians as a result of rising costs, logistical difficulties, and damaged infrastructure. To assist in addressing the nation's growing healthcare demands, the World Health Organisation (WHO) has expanded its presence in Ukraine. Innovation is desperately needed given the state of healthcare in Ukraine [16]. The WHO has

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launched a fundraising campaign to support the country's escalating humanitarian needs, providing emergency medical care, and aid in the long-term resilience of the health system.

In order to elaborate the further situation it should be noted that the prime reason for the hampering of innovation in medicine is due to a shortage of experienced medical professionals, numerous healthcare institutions have been destroyed, and the availability of services is constrained [17]. The elderly is especially affected by the recent conflict, as they form the brunt of the burden of care [18]. Numerous services have been severely disrupted [19], and millions of Ukrainians who are undergoing long-term therapies for chronic conditions are suffering because of war-related issues. Medicines availability is especially scarce in areas that are inhabited. The spread of disease is another issue, such as reports of new incidences of tuberculosis [20]. The healthcare of other countries is also indirectly affected, such as in Poland where cancers care has been experiencing new problems [21]. Expecting mothers are also in dire need of attention to their health [22]. This is where the healthcare sector has applied ingenuity, as even though the conflict itself is a limitation to innovation, the Ukrainian healthcare sector has used the war to stimulate effort into devising and applying innovative activities that range from drug distribution, medical education, and rescue services [23–25]. The Ukrainian government itself has passed new legislation to lessen the effects of these war-related difficulties and has executed these in tandem with innovative measures. This legislation simplifies the licensing, quality control, and import of medicinal products into Ukraine, gives displaced people the option of using local healthcare facilities, expands the use of the ePrescription system, allows primary care physicians to write prescriptions for refugees, and increases the number of drugs availability.

Research Problem

There is a lack of information concerning Ukraine's current state of innovation with regards to medicine. Despite the ongoing conflict in the country and the severe pressure on its healthcare system, there is little information available about the measures being taken to promote innovation in medicine in Ukraine. This lack of information highlights the need for further investigation into the state of innovative medicine in Ukraine and the measures being taken to address the challenges faced by its healthcare system.

Research Focus

The focus of this literature review is to find and assess the currently available literature on available innovative or currently being developed medicines in Ukraine. This review will include any type of study written in any language to ensure the inclusion of comprehensive information on the subject matter.

Research Questions

1. What are the currently available innovative medicines and medical technologies in Ukraine?
2. What efforts, investments, policies, or legislation are being implemented for the development of further innovative medicine in Ukraine?
3. What limitations is Ukraine currently experiencing in availing or developing innovative medicine.

Research Methodology

General Background

A literature search was conducted on several databases, including MEDLINE, Cochrane Reviews, and Pedro. Specific keywords with the conjunctions 'AND' and 'OR' were utilised, and these are displayed in Table 1. The time frame of the articles was kept beyond 2018-2022 to include only the latest data. The inclusion criteria included papers discussing any form of innovative medicine, therapy, or management of a disease. These could be experimental but had to be exclusively developed or designed in Ukraine. The exclusion criteria were any innovative form of treatment that was adopted from abroad. Also, papers published in a language other than English were excluded, but those published in Ukraine that had a translated portion were included. While this was not a systematic review, the authors felt an ordered approach to the search strategy was warranted to ensure a maximum number of articles found.

Data analysis

Information sources:

- PubMed/MEDLINE (2018-2022)
- Cochrane/EMBASE (2018-2022)
- Pedro (2018-2022)

Data items:

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- Author, Study type, Innovative medicine or approach to access, Findings

Search strategy:

The search strategy is displayed in Table 1

Table 1. Search strategy on Pubmed

#	Query	Search Details	Results	Time
1	innovative therapies [MeSH Terms]	"Therapies, investigational"[MeSH Terms]	2778	14:36:54
2	Ukraine [MeSH Terms]	"Ukraine"[MeSH Terms]	17072	14:37:19
4	(Ukraine [MeSH Terms]) AND (innovative therapies [MeSH Terms])	"Ukraine"[MeSH Terms] AND "therapies, investigational"[MeSH Terms]	0	14:37:37
7	innovative medicine AND Ukraine	(("creativity"[MeSH Terms] OR "creativity"[All Fields] OR "innovativeness"[All Fields] OR "innovate"[All Fields] OR "innovated"[All Fields] OR "innovates"[All Fields] OR "innovating"[All Fields] OR "innovation"[All Fields] OR "innovation s"[All Fields] OR "innovational"[All Fields] OR "innovations"[All Fields] OR "innovative"[All Fields] OR "innovatively"[All Fields] OR "innovator"[All Fields] OR "innovator s"[All Fields] OR "innovators"[All Fields]) AND ("medicin"[All Fields] OR "medicinal"[All Fields] OR "medicinally"[All Fields] OR "medicinal"[All Fields] OR "medicine"[MeSH Terms] OR "medicine"[All Fields] OR "medicine s"[All Fields] OR "medicines"[All Fields]) AND ("Ukraine"[MeSH Terms] OR "Ukraine"[All Fields] OR "Ukraine s"[All Fields])) AND (2018:2022[pdat])	170	14:38:50
8	(Medications [MeSH Terms]) AND (Ukraine [MeSH Terms])	"Pharmaceutical preparations"[MeSH Terms] AND "Ukraine"[MeSH Terms]	258	14:40:03
11	(Medications [MeSH Terms]) AND (Ukraine [MeSH Terms])	("pharmaceutical preparations"[MeSH Terms] AND "Ukraine"[MeSH Terms]) AND (2018:2022[pdat])	31	14:40:13

Source: created by the authors based on analysis of relevant terms that outputted the most hits in the search engine

Research results

Salient findings

The first study to analyse the literature review of the development, distribution, and procurement methods of innovative medicine within the health sector of Ukraine:

1. The majority of studies concerned the access to innovative medicine and its accomplishment instead of medicine development analysis.

2. Only one study focused on new medicines development.

3. Most studies made mention of HTA and MEA, and how this was essential to ensure convenient and open access of innovative medicines to patients.

4. Limitations were confined to economical or legislative, but efforts are being made to mitigate these.

Synthesis of studies

The table below displays notable findings from studies that fell under our inclusion criteria.

Table 2. Synthesis of studies

Author	Study type	Innovative medicine or approach to access medicine	Findings
[26]	Observational	Managed entry agreements	MEA can be used synergistically with HTA to allow access to innovative medicine
[27]	Experimental	FTIR and NMR	Clustering of water molecules as a basic ingredient for making novel medicines
[28]	Systematic review	Managed entry agreements	MEA can be used to allow ease of access to assisted reproductive technology

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[29]	Survey	Health technology assessment	Several limitations and outcomes uncovered regarding the HTA
[30]	Literature review	Novel techniques in procurement of medicines	Utilising generics and biosimilars, and controlled entry agreements for novel medications are all tools that can be exploited to ensure access to medicine.
[31]	Literature review	Reimbursement of medications for chronic illness to patients in a convenient manner.	The HTA can be used for more efficient reimbursement of medication for chronic illness such as asthma.
[32]	Commentary	Cooperation between public and private clinics	Increased availability of medications for opioid use disorder
[33]	RCT	Dietary supplement	Supplements are efficacious in improving health parameters of diabetic patients

Source: created by based on analysis 26-33 of relevant studies that fit under the inclusion criteria

Elucidation of results

Zaliska et al. sought to describe the market access for novel medicines, the phases of Health Technology Assessment (HTA) development, and the reimbursement of medications for the treatment of asthma in Ukraine. A literature review was used to perform the study, which concentrated at Ukrainian laws and academic articles on the study's topics. The findings revealed that a legal framework for the creation of the National List of Essential Medicines (NLEM) and protocols for reference pricing and reimbursement schemes were developed in 2016. Based on quality, efficacy, effectiveness, safety evidence, and economic analyses, HTA is used to decide which medications to list. The legislation, HTA training for experts on the Expert committee of the Ministry of Health (MoH), and the creation of NLEM comprised the implementation of HTA in 2016. As a result of newly enacted laws, reimbursement programs for cardiovascular disorders, 2nd type diabetes (T2D), and asthma began in April 2017 [31]. According to the study's findings, the application of HTA in decision-making in Ukraine will give patients access to cutting-edge medications and ensure an open, uniform procedure for deciding which health technologies to include on regulatory lists and reimbursement schemes.

As far as the HTA implementation is concerned, a study that sought to investigate the context of Ukraine's healthcare decision-making from the perspectives of specific stakeholder groups to promote the country's adoption of HTA. Results from two workshops using PEST methodology with two groups of HTA stakeholders in May 2019 were included in the study. The investigation uncovered both favourable and unfavourable macroeconomic aspects affecting how HTA was implemented in Ukraine. HTA-related political, economic, sociocultural, and technological factors were noted [29]. The HTA-informed system should be improved because of the analysis' findings.

The market share of medicines in Ukraine that were paid for by the state budget in 2017 was studied, and the authors suggested future initiatives to increase access to new medications by increasing the effectiveness of procurement processes. A survey of the literature using secondary sources of information was used to perform the study. The findings revealed that, in accordance with Law of Ukraine No. 269, international organisations spent EUR 0.19 billion on medications for 38 state initiatives in 2017. As a result of this engagement, the Accounting Chamber of Ukraine saw cost reductions of up to 39% in 2017 [30]. The study concludes that effective procurement in Ukraine needs to be implemented in a synergistic way based on best practices abroad and encompasses more than just finding the best deal. Utilising generics and biosimilars, establishing a competitive market through therapeutic tenders, and implementing controlled entry agreements for novel medications are all tools that can be utilised to increase efficiency. In the absence of more efficient methods of procurement, the real stakeholders to suffer are the patients. Medical companies, such as pharmaceuticals take a back seat given the current circumstances, as profit needs to be put on a low priority for the sake of patient welfare. This is easier said than done, and tackling the players involved in commerce would only breed more problems than solve. This is why the nation becomes reliant on external aid, as local companies focus almost entirely on capitalistic endeavours. A compromise should be made to at least focus on the 'essential' medications, such as those for chronic illness e.g., anti-hypertensives, anti-diabetic, anti-asthma, etc.

As far as the actual medications are concerned, Babak and Zaliska examined the primary drug markers purchased with budget dollars and in accordance with medical aid criteria, in addition to the list of new medicines registered on the Ukrainian market over the previous five years. The study's objectives were to evaluate the market access for novel drugs and find areas for advancement. The study made use of statistical observation techniques and official drug registration data from the Ministry of Health (MoH). The findings demonstrated that Ukraine's access to novel medications is severely constrained. For the period 2014–2018, only 8 novel medications were authorised on the Ukrainian market and included in national treatment guidelines. The Expert Committee only recommended one of them for the National Essential Medicines List (NEML) [26]. The study's findings support the

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need for Managed Entry Agreements (MEA) approaches to ensure the efficient use of budget monies for national state programs based on HTA data for pricing and procurement.

Other medications include treatment for opioid abuse such as methadone. Care for those who suffer from opioid use disorder (OUD) has been hampered by the escalation of the war in Ukraine [32]. In occupied Ukrainian territory, the Russian Federation prioritises methadone cessation and outlaws its use. Due to opioid injection using contaminated injecting equipment, Ukraine is experiencing one of the worst HIV epidemics in the world. A top national priority is expanding the use of pharmaceuticals for opioid use disorder (MOUD). Prior to the war, government-run and for-profit clinics in Ukraine offered MOUD. The conservative healthcare system in Ukraine has many restrictions on MOUD. Private clinics now offer a differentiated care model that gets through most obstacles seen in public clinics, increasing the number of MOUD alternatives, and streamlining the delivery of care. The cooperation of public and private institutions in distribution of MOUDs serves as an innovative example in the Ukrainian healthcare sector.

All studies included above present credible results, but because most were reviews, bias analysis from the authors did not reveal anything worth noting. The only randomised control trial in our review had a very low risk of bias but does have the limitation of being a small study. The other experimental research on FTIR and NMR has been cited by multiple studies and shows sound scientific analysis of the experiment's result.

Discussion

Even while there aren't many publications describing the use of innovative medicine in Ukraine, this in no way suggests that there isn't any effort being made in this direction. It simply means that there isn't much coverage, which the most recent war can be blamed for. The question is that if indeed there is a sizeable amount of ongoing activities in designing, developing, distributing or even researching innovative medicine, then why haven't these been given been brought to the forefront. Its possible language barriers are one of the reasons, but given that the current global focus in on Ukraine, it was expected that more material would be available. And in the scenario if there aren't really a good number of articles covering innovative medicine, then the question arises that why hasn't the due investment of funds and effort been made to accomplish this. Even if we consider the economic barriers, there still should be enough for emulating the creating and distribution of innovative medicine like in other countries. Moreover, policy makers have a key role in ensuring the success of this.

From the above results, it appears that so far the only success has been made into devising strategies to actually make innovative medicine affordable. This is understandable as the need of the hour is the ease of availability of medicines to the public. Health policy makers probably deem those affected by the war, or those living in poor circumstances are priorities and thus the main focus is on 'supply' instead of 'development'. This is reinforced a by a study that talks about how Ukraine's legislative system controls the supply and standard of medical supplies and services [34]. It draws attention to discrepancies in sexual orientation, age, and geographic location in the frequency of referrals for medical professionals, as well as economic, physical, and informational accessibility. The challenging financial condition and lack of treatment funding are the key contributors to uncertainty. Because there are fewer medical supplies and services available in rural areas than in urban ones, the health of the rural population is worse. The staffing and financial support of healthcare in Ukraine and EU nations are compared, and strategies to increase accessibility and quality are presented.

While effort put into making innovative medicine easily available is a commendable endeavour in itself, it still does not bring Ukraine up to the mark in being the forefront of innovation in medicine. Health assessment technology is one innovation to that Ukraine can benefit from investing further into this option. To illustrate the strategy being employed, a research, with the help of national stakeholders, aimed to offer a customized HTA application path for Ukraine [35]. Policymakers, executives from pharmaceutical firms, and representatives from patient organizations participated in a poll. The findings indicated that although financing for HTA study was now scarce, it will grow going forward, mostly from public sources. Organizationally, a public HTA organization with academic backing was most favoured. The importance of healthcare and cost effectiveness was the main determining factors in judgments. Ukraine is only beginning to adopt HTA, and this study gives national stakeholders a clear picture of the future orientations. Both MEA and HTA [36] can still be emulated by other developing countries that can look towards Ukraine as a model; however, whether or not healthcare systems in third-world countries do indeed look towards Ukraine as a model to emulate still remains unclear as there is no clear indication in current literature.

By far the most impressive of the innovative medicines that deserves more spotlight is the FTIR and NMR used to devise novel medicines [37, 38]. While still experimental, it shows promising results, and this can serve as not only an initiative but a template for other parts of the healthcare sector to utilize. At the moment, the technology is only used to aid in clustering of water molecules, but potential applications of this can expand beyond healthcare, such as food and agriculture, though discussions of those applications take a back seat to healthcare due to the scope of this literature review.

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It is interesting noting that there was a lack of articles discussing innovative measures in devising medication for chronic illnesses. While palliative care has been given due importance [39], the same cannot be said for management of chronic diseases. This is significant as chronic illnesses comprise the majority of the illness-stricken population, the lot of which belong to the geriatric category [40–42]. This is reinforced by a study which set out to identify the incidence of no communicable illnesses (NCDs) in order to analyse the perceived impact of conflict on the severity of NCDs as well as accessibility to treatment among individuals impacted by conflict in Ukraine [43]. Two cross-sectional household surveys that were stratified, population-representative, were performed among adult internally displaced persons across all of Ukraine and adult residents of Donbas in eastern Ukraine. The study discovered a significant incidence of NCDs in both populations and pointed out barriers to receiving medical attention and prescription treatment. In Donbas, more displaced people than safer adults reported experiencing psychological anguish, care disruptions, and medication interruptions. The study recommended that to address the particular requirements of these communities, there is a demand for tailored policies and initiatives. Given the increase in longevity and the rapid pace of aging in recent decades, an older population may be disproportionately impacted by humanitarian crises than in decades past. Although they have been identified as a vulnerable population in humanitarian crises, older people have not historically been given priority in humanitarian aid. Though there are specific recommendations on including this population during humanitarian crises and international guidelines that take elderly individuals into account, their practical applicability in the real world is still limited. The older population faces specific difficulties and barriers in humanitarian settings, such as barriers to obtaining food, clean water, and medical care; comorbidities and a greater susceptibility to illness, starvation, impairment, and trauma; a greater likelihood of prejudice and assault, especially for those with handicaps; insufficient treatment for chronic illnesses; a lower socioeconomic status with monetary reliance and social and economic disadvantages. Thus a greater emphasis is imperative to be placed on the development and procurement of chronic medications.

Until the war recedes, investment and effort into innovative medicine will remain sluggish. Healthcare policymakers can resolve this somewhat by taking a tactful approach. It is possible to increase the accessibility of medical supplies and services in Ukraine in a number of ways, such as sending unused medical supplies to Ukraine, offering on-site medical assistance or other remote services like telemedicine, enlisting the help of respectable organizations that can send aid. Other countries like Israel have provided training through its national field hospitals to Ukrainian healthcare personnel [44]. Certain specialized services, such as for patients with chronic kidney diseases, have also shown their effectiveness [45]. As WHO has already committed a sizeable amount in its own support the health sector of Ukraine must also increase its efficiency. This requires concentrating on patient needs, and replacing the outdated healthcare system. Implementing the new healthcare finance system is the first stage, where patient comes before profit. Instead of paying for hospitals, doctors, and inpatient beds, the state should now allot funds for a patient's particular requirements.

Conclusion and Implications

1.The current state of innovative medicine development in Ukraine is unknown.

2.Efforts are being made towards improving access to innovative medicine in Ukraine using Health Technology Assessment (HTA) and Managed Entry Agreements (MEA).

3.There is ease of access to the procurement of medicines for chronic illnesses.

4.Economic and legislative limitations need to be overcome in order to ensure further development and distribution of innovative medicine in Ukraine.

5.Future directions should involve higher investment in innovative medicine by ensuring that stakeholders have sufficient resources.

Prospects for further research

Since this is the foremost study that attempts to assess the availability or development of innovative medicine, it can be used as base for prospective research by other groups. Bu it would require more field work into investigating the actual situation in the development, distribution, and procurement of innovative medications. This can be hampered by the ongoing war efforts, but remains critical to accomplish, nonetheless.

Limitations

The study was unable to synthesize comprehensive information regarding the subject matter due to the lack of availability of literature. One reason may be that much of the information has either not been published in journals yet or is not indexed in the top search engines. Moreover, since we did not include articles that were in a completely different language than English, it's possible that some of that information may have been missed.

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Declaration

Author contribution

All authors have sufficiently contributed to the study and agreed with the results and conclusions.

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Ethical statement

This study does not require IRB approval as it does not involve human subjects/data.

Declaration of interest

No conflict of interest is declared by authors.

Data sharing statement

Data supporting the findings and conclusions are available upon request from the corresponding author.

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