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Undergraduate occupational medicine education in European Medical Schools: better training to meet today's challenges

Marcos Larrosa[1,2], Petar Bulat[3], Nicole Majery[4], Jean-François Gehanno[5], Elena-Ana Păuncu[6], Marjolein Bastiaanssen[7], Lode Godderis[8], Isabel Iguacel[9*], Florina Georgeta Popescu[6], Soile Jungewelter[10], Lutgart Braeckman[11] and Begoña Martínez-Jarreta[12]

Abstract

Background Occupational medicine (OM) faces considerable challenges today, one of them related to the university training of future physicians considered suboptimal at a global level as it has been pointed out in many studies. The aim of this study is to update the state of OM medical education in European universities.

Methods Between March and August 2022, an e-mail survey regarding OM training to undergraduate medical students was conducted among OM professors at European universities in 28 countries ($n = 347$).

Results Of the 347 universities, 53 medical schools from 19 countries responded (response rate = 15.3%). In 89% of cases, OM was taught. The average number of hours per academic year was 24.3, with significant variation within the same country. Lectures were the most popular teaching technique (98%), with a considerable use of modern approaches such as problem-based learning (61%), and e-learning (57%). While occupational diseases and principles of prevention were covered, other subjects such as the environmental impact or collaboration with an OM physician were poorly represented in the educational program.

Conclusion According to data, several European medical schools may provide insufficient OM education and training to their students. The education of undergraduate occupational medicine students in European medical schools should be designed to equip them with the knowledge and skills required to meet today's challenges. It is critical that undergraduate OM education in European medical schools be enhanced, harmonized, and standardized.

Keywords Medical education, Undergraduate teaching, Occupational medicine, Europe

*Correspondence:
Isabel Iguacel
iguacel@unizar.es
[1]Internal Medicine Department, University Hospital Lozano Blesa, Zaragoza 50009, Spain
[2]Scientific Research Group GIIS-063 (IIS-Aragón), Zaragoza 50009, Spain
[3]Department of Occupational Health, Faculty of Medicine, University of Belgrade, Belgrade 11000, Serbia
[4]Service du Santé au Travail, Multisectoriel (STM), Luxembourg 1630, Luxembourg
[5]Institute of Occupational Medicine, Rouen University Hospital, Rouen 76000, France
[6]Discipline of Occupational Health, University of Medicine and Pharmacy "Victor Babes", Timisoara 300041, Romania
[7]Radboud universitair medisch centrum, Postbus 9101, 6500 HB, Nijmegen (149), The Netherlands
[8]Centre for Environment and Health, KU Leuven, Leuven 3000, Belgium
[9]Faculty of Health Sciences, University of Zaragoza, Zaragoza 50009, Spain
[10]Finnish Institute of Occupational Health (FIOH), Helsinki FI-00250, Finland
[11]Department of Public Health and Primary Care, Faculty of Medicine and Health Sciences, University of Gent, Gent, Belgium
[12]Occupational Medicine, Faculty of Medicine, University of Zaragoza and Scientific Research Group GIIS-063 (IIS-Aragón), Zaragoza 50009, Spain

Background

Despite all efforts made, the specialty of Occupational Medicine (OM) is still under-valued by doctors, and it is not clearly recognized as an influential medical discipline that produces transversal knowledge and skills, which are necessary for medical specialties [1, 2]. Moreover, among employees, the misconception that OM represents employers' interest persists and they are more likely to trust the general practitioners (GPs) or other medical doctors rather than the OM physician [3–5]. In fact, GPs are trusted by workers when they need information or advice regarding work-related health problems, occupational hazards in their company or their fitness to return to work [3, 5]. Besides, employees in small and medium-sized businesses in many European nations are unable to obtain occupational health services, thus they must rely on the knowledge and skills of their GPs in occupational medicine [6, 7]. Therefore, although communication between OM physicians and GPs is essential to help GP to detect occupational diseases or advising on return to work [4] it has been reported a poor interaction and lack of communication [8–10]. Among the root reasons, GP and those graduated in medicine worldwide generally receive very limited training in OM [11–14].

Since the initial publication of the report about OM training in 1974 in which it was pointed out that the training in OM was insufficient [15], several reports have been conducted around the globe examining the situation of OM training in different countries (Table 1).

More than just academics have attempted to raise awareness of this issue. In 1988, the World Health Organisation (WHO) released a report that raised alarms about the disparities in medical education across students, even within the same region [34] and later the American College of Occupational and Environmental Medicine (ACOEM) and the International Occupational Medicine Society Collaborative (IOMSC), have published reports to point out the need to improve OM undergraduate medical student training. However, it was not the specific topic of these studies [1, 13, 14].

For the first time, in 2014, Gehanno et al. conducted a survey to examine the undergraduate training of medical students in OM in different European countries [35]. The research was supported by the European Association of Schools of Occupational Medicine (EASOM) and revealed the need to improve undergraduate training in occupational medicine at European universities [35]. The findings of this research also indicated that while most medical schools in Europe offered undergraduate training in OM, there was considerable variability between universities in different European countries and even within the same country. In short, there was a lack of harmonisation in terms of topics, number of hours devoted to training, and so forth. However, ten years later, the field of OM is facing new challenges on a global scale such as the shortage of OM doctors [21]. To overcome these difficulties medical student training at the undergraduate level is needed as a pivotal component in addressing the present shortage [1, 21]. Education and training are highly valuable tools to change student´s perceptions towards OM [11].

Irrespective of the vocation for occupational health that could be fostered in medical students, adequate training in OM is essential for many reasons. As Lalloo et al. recently stated in 2024 [12], every doctor should be competent to recognize occupational diseases/illnesses, assist their patients in returning to work after illness or injury, and understand the principles of retaining workers with long-term health conditions in the workplace. In addition, early exposure of medical students to occupational safety and health can help them understand the importance of work as a health outcome [12].

In the light of these considerations, it is of interest to examine whether the OM training of medical students in European medical schools has overcome the shortcomings described in this regard a decade ago. Especially when countries such as the UK have taken the initiative and led the most recent call for action on this issue with the publication of a new OM Competence Framework for Great Britain medical students [12]. In this context, with the most recent publication on the status of OM in European medical schools occurring a decade ago [35] the purpose of this study was to examine the reality of medical education in OM in European medical schools at present time.

Table 1 Articles discussing OM training situation (sorted by country)

United Kingdom (UK)	Harrington et al., 1989 [16] Wynn et al., 2003 [17] Williams et al., 2011 [18] Lalloo et al., 2024 [12]
United States of America	Burstein & Levy, 1994 [19] LaDou, 2002 [20] Green-McKenzie et al., 2021 [21] Green-McKenzie et al., 2022 [1]
Canada	Tyler et al., 2009 [22] Baillargeon et al., 2011 [23]
Turkey	Hamzaglou et al., 2005 [24] Yavuz et al., 2011 [25] Yildiz et al., 2012 [26]
Australia	Shanahan et al., 2000 [27] Shanahan et al., 2010 [28]
Egypt	Al-Batanoty & Shebl, 2012 [29]
France	Gehanno et al. 2005 [30]
Italy	Apostoli, 2017 [31]
Croatia	Žaja et al., 2021 [32]
Spain	Iguacel et al., 2022 [11]
China	Ding & Cheng, 2024 [33]

Methods

Study design

A descriptive study was designed to determine the status of OM teaching in Europe. Between 1 March and 1 August 2022, an email survey was sent to all the medical schools or faculties ($N=347$) across 28 European countries on "OM Training in European Medical Schools" (Belgium, Bosnia and Herzegovina, Croatia, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Italy, Malta, Latvia, Moldavia, Montenegro, Netherlands, Norway, Poland, Portugal, Macedonia, Romania, Serbia, Slovenia, Spain, Sweden, Switzerland, Turkey, and UK). Finally, 53 medical schools from 19 European countries returned the completed questionnaire. This represents a response rate of 15.3% (53 out of 347) and includes information covering more than 75,000 European students, as reported by the universities.

All these countries were represented in the EASOM or had links to members of this association due to collaborative activities.

The questionnaire used in the present study was identical to the one used by Gehanno et al. [35] (Supplementary material, Table S1). The survey design was influenced by prior research on undergraduate OM teaching in France and the UK [17, 30]. Later, improvements were made to the project members' input. Finally, a pilot test was carried out at their respective universities, with subsequent changes. The final version was a 2-page, closed questionnaire, with the inclusion of open-ended questions at the end of the survey.

Questionnaires were sent via e-mail to the teachers in charge of undergraduate teaching of OM in all medical schools, identified through the EASOM network. In the event of a responsible teacher could not be located, the medical school dean was furnished with the questionnaire. If no response was forthcoming, in order to increase response rates, an email reminder was sent after a month, followed by another reminder after two months.

Ethics approval and consent to participate

The ethics committee of Aragon (Research Ethics Committee of the Autonomous Community of Aragon, CEICA), Spain, was consulted but the present study did not require any assessment according to the CEICA Even though, the consent to participate was also considered unnecessary since no personal data of any kind are collected, a data management agreement was signed with the University of Zaragoza, Spain for data protection (I.D: 100621).

Results

Responses were obtained from 19 countries out of a total of 28 countries that were invited to participate (68%) (Belgium, Bosnia Herzegovina, Croatia, Denmark, Finland, France, Germany, Greece, Hungary, Italy, Latvia, Netherlands, Norway, Portugal, Macedonia, Romania, Serbia, Slovenia, and Spain).

The percentage of medical schools responding in each country was uneven, ranging from 100% of medical schools in countries such as Bosnia Herzegovina, Greece, and Latvia, 75% in Hungary, 70% in Denmark, 63% in Romania, 50% in Belgium and Slovenia, or 40% in Finland and Serbia, among others. The lowest response rate was obtained in three countries with a strong historical tradition of OM teaching and training, such as Italy, Germany, and France (Table 2).

Four Greek universities, one German university, and one Belgian university, making a total of six respondents (11% of the sample), indicated that OM was not taught in their medical schools. The remaining 47 universities (89% of the sample) reported that they provided formal OM training. 20% of respondents indicated that OM was taught in the first years of their university career, whereas 80% indicated that it was taught in the last years of the degree (20% vs. 80%).

The mean number of OM training hours per academic course was 24.3 h with variability even within the same country. For instance, in Spain, there is a discrepancy of 100 h between the minimum (25 h) and the maximum (125 h). In 28% of cases ($n=14$), the duration of OM teaching was limited to 10 h or less, while in up to 46% ($n=23$) of cases, the duration was 20 h or less.

In terms of teaching methods, most respondents reported to use lectures (98%), followed by seminars (76%), with a proportion using more contemporary approaches such as problem-based learning (61%) and e-learning (57%). Other methods such as workplace visits (43%), short work placements (30%), project work (30%) and ward-based- tuition (13%) were used in less than half the cases (Table 3). In summary, all teaching methods experienced an increase compared to the previous study.

The most frequently training topics in OM were occupational respiratory diseases (89%), principles of prevention (89%), occupational health law and ethics (79%) and musculoskeletal disorders (79%). (Table 4).

These topics are closely followed by others such as occupational cancer (74%), stress at work (74%) and occupational hazards for physicians (74%) (Table 4).

The least frequently taught topics included the following: medico-legal reporting (38%), disability assessment (40%), and environment and effects of industrial activity (43%), which were among the topics found at the bottom of the list. Consequently, less than half of the students received training in these subjects. Moreover, nearly half of the students received training in ergonomics (55%), and in how to collaborate with the OM physician (55%) (Table 4).

Table 2 Responses per country and hours of formal instruction in OM (lectures and seminars) in the present study (2022) compared to the study of Gehanno et al., 2014 [35]

Country	Nº of universities	Answers	Response rate 2022 (%)	Response rate 2014 (%)	Mean hours lectures 2022	Mean hours lectures 2014	Min 2022	Max 2022
Belgium	8	4	50	89	**9.9**	**13.4**	0	18
Bosnia and Herzegovina	4	4	100	80	**35.6**	**53.5**	22.5	45
Croatia	5	1	20	50	**25.0**	**35.0**	-	-
Czech Republic	8	0	0	13	-	**24.0**	-	-
Denmark	4	3	75	100	**16.0**	**35.0**	5	23
Finland	5	2	40	20	**60.0**	**71.0**	-	-
France	36	3	8	94	**8.3**	**10.3**	4	13
Germany	36	2	6	17	**15.0**	**34.8**	0	30
Greece	8	8	100	100	**12.1**	**21.1**	0	38
Hungary	4	3	75	25	**16.0**	**15.0**	6	28
Italy	37	2	5	88	**24.5**	**34.6**	14	35
Malta	1	0	0	0	-	-	-	-
Latvia	1	1	100	-	**30.0**	-	-	-
Moldavia	1	0	0	100	-	-	-	-
Montenegro	1	0	0	100	-	**63.0**	-	-
Netherlands	8	2	25	100	**7.5**	**37.1**	5	10
Norway	4	1	25	75	**10.0**	**36.3**	-	-
Poland	13	0	0	0	-	-	-	-
Portugal	10	2	20	17	**24.0**	**0.0**	20	28
Macedonia	3	1	33	33	**65.0**	**65.0**	-	-
Romania	11	7	64	33	**30.9**	**32.7**	28	42
Serbia	5	2	40	100	**45.0**	**36.8**	45	45
Slovenia	2	1	50	100	**30.0**	**37.5**	-	-
Spain	55	4	7	26	**61.0**	**27.7**	25	125
Sweden	6	0	0	0	-	-	-	-
Switzerland	5	0	0	40	-	**17.0**	-	-
Turkey	36	0	0	6	-	**15.5**	-	-
UK	30	0	0	10	-	**6.0**	-	-
Total	347	53	15	44	**24.3**	**25.5**	0	125

Table 3 Educational methods employed by medical schools in the present study (2022) compared to the study of Gehanno et al., 2014 [35]

Teaching Methods	Nº of schools ($n=46$)	Percentage 2022 (%)	Percentage 2014 (%)
Lectures	45	98	91
Seminar tutorials	35	76	52
Problem based learning	28	61	26
e- learning	26	57	20
Workplace visits	20	43	38
Short term internships	14	30	29
Project Work	14	30	16
Ward-based intuition	6	13	9

Out of the 47 faculties that taught OM, 36 (77%) indicated that they assessed their students with an exam, while 11 (23%) did not require an exam to pass the subject. The preferred method was the multiple-choice test (70%), followed by oral exams (38%) and open questions (38%). When asked if they felt their opinion was representative of other OM faculties in their country, 55% felt it was.

Discussion

The aim of this study was to provide an updated overview of occupational medicine (OM) education for medical students in European medical schools. The results of this study give an insight into the current state of OM education for undergraduate students in European medical schools, with a comparison to the conditions that existed ten years ago.

The present survey outcomes are consistent with those of the previous study by Gehanno et al. [35]. It should be noted the variability in the number of hours devoted to OM training, the covered topics and the compulsory or voluntary nature of the training, among others in undergraduate OM training across European countries. Furthermore, it was observed that there is a general tendency

Table 4 OM issues in European universities ($n=53$) and mean number of hours of each one in the present study (2022) compared to the study of Gehanno et al., 2014 [35]

	N	Percentage 2022 (%)	Percentage 2014 (%)	Mean Nº of hours 2022	Mean Nº of hours 2014
Principles of prevention	47	89	96	1.7	1.7
Occupational respiratory disease	47	89	89	2.8	2.5
Occupational health law and ethics	42	79	85	1.4	1.2
Occupational-related musculo-skeletal disorders	42	79	81	1.7	1.6
Risk assessment in the workplace	40	75	72	2.1	1.9
Health and safety risks to doctors in the clinical environment	39	74	79	1.8	1.3
Occupational cancers	39	74	77	1.7	1.6
Occupational stress / Mental health and work	39	74	72	1.8	1.6
Occupational skin disease	38	72	78	1.5	1.4
Occupational toxicology	37	70	85	3.3	2.8
Occupationally acquired infections	37	70	65	1.6	1.3
Occupational history taking	36	68	58	1.9	1.5
Workers' compensation	33	62	69	1.3	1.3
Workability assessment	32	60	48	1.3	1.6
Disability and return to work	31	58	44	1.7	1.1
Principles of work ergonomics	29	55	58	1.9	1.5
How to collaborate with the occupational physician	29	55	57	1.3	0.9
History of occupational medicine	29	55	48	1.3	1.1
Environmental impact of industrial activity	23	43	46	1.4	1.7
Assessment of disability	21	40	30	1.9	1.4
Writing medicolegal reports	20	38	30	1.6	1.4

to prioritize classical content (occupational diseases, history of OM) over topics that have grown in significance within the field of OM recently. These encompasses collaboration between general practitioners and OM specialists, return to work, and environmental effects.

Our results showed that the adaptation of training to new contexts and needs is frequently suboptimal. Perhaps the most obvious example is that themes that have acquired prominence in the recent decade, such as occupational cancer [36] and psychosocial risks [37], are in very similar numbers to those of 2014. In other words, one in every four students at European institutions receives no training in these areas.

Another illustrative example of the results of this study is the increase in OM history instruction from 2014 to the present (55% vs. 48%) In contrast, the environmental impact of industrial activity, which is the topic most closely related to the climate emergency, had not only decreased in terms of its percentage of instruction (43% vs. 47%), but also the number of hours (1.4 h per week vs. 1.7). Furthermore, a comparable trend was observed in another relevant topic: "How to collaborate with the OM physician." The proportion of respondents who indicated receiving instructions on collaborating with the OM physician remained relatively unchanged, with a slight decrease from 57 to 55%. This finding underscores the need for a new shared competency framework for medical students studying OM within European countries, including the UK. Such a framework would standardize competencies and enhance collaboration between medical professionals across Europe [12].

Nevertheless, our findings indicate an increasing use of modern instructional tools and methodologies, particularly learner-centered approaches such as problem-based learning and e-learning. These methods have been proposed as effective in stimulating students' interest in OM [11, 33, 38]. This focus on more technological methods has not prevented other approaches from increasing, albeit less than desired. Practices that have been shown to be beneficial, such as visits to work environments and work placements [21], have only experienced a slight increase (43% vs. 38%). Nevertheless, it should be bear in mind that our present survey was conducted during the first quarter of 2022, in the context of the COVID-19 pandemic.

Moreover, a potential increase was observed in the average time spent on OM teaching, compared to 2014, although in the most favorable scenario, the average time spent on occupational health teaching was less than 30 h during the academic course. However, currently some medical faculties do not include OM in their curricula, despite of the importance in acquiring core OM competencies [12–14, 21]. This implies that a proportion of medical students at European universities have limited

or no opportunity to study occupational medicine (OM) during their undergraduate training. It is therefore reasonable to assume that the lack of knowledge about essential aspects of occupational medicine (OM) and the lack of necessary skills will have a negative impact on their future professional performance as physicians.

It should be noted that this inconsistent fragmented scenario among countries occurs in a continent that offers the best conditions for academic harmonization due to its geopolitical location and common academic regulations [39]. The global situation drawn by other institutions such as ACOEM and IOMSC in their joint reports of 2017 and 2022 is even more concerning. Hence, our findings show no real improvement on the situation described a decade ago [35].

It must be reminded that basic university training in this area was identified by Green-Mckenzie et al. [1, 21] as one of the most critical factors that would motivate a young doctor to pursue a career in OM. Furthermore, these authors have recently reported on similar needs in the training of their students in United States medical schools and their relationship to the vocational deficit and the consequent decline of occupational and environmental specialists that the United States currently faces.

It is also worth recalling how the COVID-19 pandemic revealed significant deficiencies in the occupational safety and health (OSH) training of health care workers. In the early weeks of the epidemic and in the aftermath of the pandemic, healthcare workers with inadequate occupational safety and health training were unnecessarily exposed to the COVID-19 virus, resulting in the deaths of a significant number of healthcare workers [1]. In addition, the pandemic demonstrated the vital role of occupational health and safety professionals in maintaining the functioning of production systems and their workers [40]. Adequate training in occupational and environmental health and safety is essential to prepare new physicians for any new pandemic or crisis that may arise in the future (including that related to climate change).

Once again, we must not underestimate the lack of OM training in medical schools in Europe, because it is a major problem, as is the decline in the number of occupational health physicians in Europe, their replacement, and the readiness of our doctors to face a possible new health crisis in the future [2]. The results obtained justify an urgent debate on the competencies/knowledge that every doctor should possess in OM upon completing their medical school curricula. It is necessary to establish a core curriculum for undergraduate training in OM in Europe and implicate OM professional associations as well as international organizations directly involved in the OM field. With a substantial sample distributed around Europe, this study's international viewpoint and extensive information make it a valuable source of data to evaluate. Despite its limitations, the agreement with Gehanno's results [35] invites us to consider the data obtained as trustworthy.

However, it is important to note that the findings of this study are limited as not all European countries were included. Adding to that a significant drop in the response rate (15.3% vs. 44.3%) is observed in this second survey. Several possible explanations can be put forward for this relatively low response rate. It is reasonable to assume that most of the non-respondents do not incorporate significant levels of OM teaching into their medical student curriculum. In other words, the universities that were unwilling to participate in the study may be those that do not offer adequate OM teaching. Indeed, in this second survey, responses were received from a small number of European universities stating that OM training was not offered at all in the undergraduate curriculum of their medical school. Consequently, while data from the current study are compared with those from a 2014 study, it is acknowledged that the composition of participating faculties may have differed between the two time periods. Variations in faculty demographics and expertise could potentially impact the comparability of results, affecting the validity and reliability of the findings.

Another potential explanation for this low response rate is the ageing of the OM workforce in recent years. This trend may also extend to OM teachers in medical schools. As previously highlighted, it has been observed that the OM workforce is ageing, with up to 40% of practitioners over the age of 50 [13, 41]. This situation is of significant concern, as the lack of adequate generational replacement of occupational physicians teaching in medical schools could exacerbate the consequences of suboptimal undergraduate education in occupational medicine.

Moreover, while a 100% response rate was achieved in some surveyed countries, responses from nations such as France, Italy, and Germany were notably scarce, despite the long-standing tradition of OM undergraduate teaching within the medical curriculum in these countries. This implies that a representative sample of all Faculties of Medicine was not obtained from European nations.

The very recent publication in 2024 of a new Competence Framework in Occupational Medicine for the training of new doctors in all UK medical schools [12], which puts an end to the fragmentation, lack of standardization and inconsistency that had been proven to exist [15–18] within different UK universities, may be a good example to consider at this time. An example to consider as it has been defined after years of study, with the involvement and consensus of all parties concerned and established from a pragmatic perspective to respond to real needs.

Although there may be local differences between medical schools in different European countries or within

individual nations, a basic OM competency framework should be generated, established and required for all European countries. It is needed to ensure that every European graduate has "the necessary knowledge and skills to deliver positive OM outcomes for patients, as well as the tools to manage their own resilience and the demands of a career in medicine, whatever their chosen" [12]. In European Union (EU) member countries, such a common basic OM competency framework must be considered not only a necessity, but as a mandatory requirement based on the European Community legislation related to the free movement of professionals [39, 42].

It is imperative that undergraduate OM instruction in European medical schools to be updated, harmonized, and standardized. But to address this issue, European societies, regulatory agencies, academic institutions, and policy makers must work together promptly. Cooperation of WHO, International Commission on Occupational Health (ICOH), European Union information agency for occupational safety and health. (EU-OSHA), International Labour Organization (ILO), European Union of Medical Specialists of occupational medicine (UEMS-OM), and other international organizations is also needed.

Conclusions

The data indicate that a substantial proportion of European medical schools may be providing suboptimal OM teaching and training to their students. In addition, there is evidence of a significant lack of updating, standardization, and harmonization of OM teaching both between and within European countries. These problems were identified a decade ago by an EASOM team [35] but remain largely unaddressed.

There is a need to develop a common framework of core competencies in OM in EU member countries. The establishment of such a common framework is of utmost importance to ensure that all European physicians are adequately equipped with core competencies in OM to meet current needs and are also to be prepared for future challenges such as those posed by the COVID pandemic.

The establishment of this framework should be seen as a mandatory requirement in accordance with European Community legislation related to the free movement of professionals within EU countries.

OM education at the undergraduate level must no longer be underestimated. It has a great importance and needs to be urgently addressed and improved definitively.

Abbreviations

ACOEM	American College of Occupational and Environmental Medicine
EASOM	European Association of Schools of Occupational Medicine
EU	European Union
EU-OSHA	European Union information agency for occupational safety and health
GP	General practitioner
ICOH	International Commission on Occupational Health
ILO	International Labour Organization
IOMSC	International Occupational Medicine Society Collaborative
OM	Occupational Medicine
UEMS-OM	European Union of Medical Specialists of occupational medicine
UK	United Kingdom
WHO	World Health Organisation

Supplementary Information

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Supplementary Material 1

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Author contributions

All authors contributed to the study conception and design. Material preparation and data collection was performed by PB with collaboration of the rest of the authors. Formal analysis and investigation were performed by ML, II and BMJ. The first draft of the manuscript was written by ML with BMJ supervision. Writing-review and editing were performed by II and BMJ. All authors read and approved the final manuscript.

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Data availability

No datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate

Not applicable. The Comité de ética de la investigación de la Comunidad autónoma de Aragón (CEICA), Spain has confirmed that no ethical approval is required.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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