

Review

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Review

Occupational Health Nursing as a Compulsory Subject: Innovation in a Spanish University Degree

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Abstract: Background/Objectives: The objective of this manuscript was to explore the situation of Occupational Health Nursing as a mandatory subject in the curriculum of Nursing Degrees in Spanish Universities and compare it with the situation in the Medicine ones. **Methods:** For this purpose, a integrative review study was carried out including both scientific and gray literature. **Results:** The results show that, in Nursing Degrees only two universities offered, since the 2024-2025 academic year, compulsory subjects, one of which offers it with its own corpus and 3 credits, while in Medicine only one university offered it as mandatory (along with legal). **Conclusions:** The innovative proposal on the incorporation of a mandatory and specific subject about occupational health, along with others associated with nursing specialties, could serve as a model for its incorporation into Spanish university Nursing Degrees.

Keywords: occupational health; nursing; medicine; university subject; curriculum

1. Introduction

The literature shows historical references about occupational health nursing (OHN) since 1872 in UK with important achievements according to Harrison et al [1] (Harrison 2005). Also in Scotland [2]. In USA, Cahal mentions that University of Cincinnati included occupational health content in the College of Nursing and Health Programs, dating back to 1914 [3]. In 1969, Brown published his study on training and education of OHN in USA [4]. Later on, in 1973, Courtney, his work about the beginning of OHN graduate education at the University of North Carolina [5], and Talbot, in 1983, an educational model to prepare the baccalaureate nurse for OHN [6]. Keller, in her article derived from her presentation "Nursing Education and the Occupational Health Setting" given at the 101st Annual Meeting of the American Public Health Association (California, 1973) disagrees with the idea that OHN does not was included in the curriculum of American university nursing studies [7]. However, Prestholdt and Holt stated in 1989 that OHN had received little attention in undergraduate nursing education [8]. None in countries like Italy, since as La Torre mentions, in contrast to Europe, the figure of the OHN is not yet present, due to the absence of contractual and university fields [9]. (La Torre, 2020). Data that contrasts with those indicated by Hong on the Asian continent, indicating that most nursing curricula include OHN in the Community Health Nursing course for fourth-year students in South Korea [10].

In Latin American level, the 2023 article by Valencia et al stands out, who review the situation in Chile, Colombia, Brazil and Mexico, observing a heterogeneity in the countries analyzed in the OHN teaching in the university degree studies analyzed [11].

In Spain, 65 years have passed since the creation of the then called "Company Medical Services Organization –OSME– [12]. (OSME), although the starting point of the existence of OHN was the

publication, in 2005, of the Spanish official state bulletin (BOE) on Nursing specialties, being one of the seven that were established as such [13]. Subsequently, in 2009, the BOE of the training program for OHN specialty was published [14]. Since then, there has been an access route to nursing specialties in Spain through the “Resident Internal Specialist” exam –EIR- [15].

Regarding OHN functions, Bardalet et al proposed in 2002 a first list of it in Spain, identified through discussion in an occupational health work group [16], which had their continuity in the proposed professional competences by the working group made up of members of the nursing commission of the Societat Catalana de Seguretat i Medicina en el Treball in 2006 [17]. These competences were after analyzed by Gonzalez in his study [18]. Recently, a manuscript analyzes the situation of OHN in Spanish universities until the 2023-2024 academic year [19].

Regarding Occupational Health Medicine (OHM) there are also differences about the training in the European Union countries [20]. In Spain, where OHM is one of the medical specialties that can be accessed through the “Medical Internal Resident” –MIR- exam Lopez et al published, in 2007, a pioneering article on specific subjects or subjects related to OHM in Spanish Medical Faculties, concluding, at that time, the need for all faculties to have OHM subjects [21]. Almost a decade later, Maqueda stated that OHM is not part of the areas of knowledge into University academic action [22].

The fact that there are more than three billion working people in the world [23], and the permanent changes in the labor market with emerging risks, justifies that there should be mandatory and specific subjects on occupational health in undergraduated nursing and medicine university studies. In this sense, the objective of this study was to review and update the situation of OHN as a mandatory subject in Nursing Degrees and its comparison with that OHM in Medicine Degrees at Spanish universities.

2. Materials and Methods

A study of integrative review of scientific and gray literatura was carried out by a multidisciplinary team that included both student and profesors with specialties of OHN, OHM and an expert in health management.

In a first phase, literatura was collected to know the background and the situation at the international and national level. To do this, a bibliographic search was carried out using the Medline and Scopus databases, with the search equation: (“occupational nurses” OR “occupational health nursing”) AND (“study program” OR “university subject” OR “university” OR “nursing curricula” OR “nursing curriculum”). The literature search was done in parallel and independently by two researches. As inclusion criteria, it was established that it be written in English or in Spanish, excluding those found in another language. Also that the full text could be accessed through the university bibliographic service.

Given the scarcity of articles on the situation in Spain, a second review of manuscripts in JCR and gray literature was carried out, both through a bibliographic search using “Google Scholar”, and through another review identified after attending a national scientific conference on occupational health [24]. For this second phase, the inclusion criteria were established as undergraduate university studies, excluding postgraduated ones (master degrees, doctorate, or own degrees). Subjects of OHN, OHM, occupational health, and/or occupational risk prevention from public and private university faculties were included.

In a third phase, based on two selected studies, one on the OHN teaching, and another on OHM [19, 21] in order to update the information during the 2024-2025 academic year, analyzing and contrasting the results of those manuscripts with the official website links and/or bulletins from each of the degrees or the selected university faculties. This manuscripts specifically dealt with the situation of OHN and OHM in Spanish universities. The study plans of each of the faculties were analyzed, eliminating those that appeared duplicated in the same university.

From this update and the bibliographic search and other sources, a representative sample of all the Nursing and Medical Spanish faculties [25, 26] was obtained. In this phase, those centers that,

although included subjects with occupational health content did not specifically represent it (such as community nursing, public health, preventive medicine, etc.), were excluded.

In a fourth phase, a summary table was prepared with updated data for the 2024-2025 academic year for the selected university centers. The inclusion criteria were established that the subject of OHN and/or OHM (or with synonymous terms) was basic, core, mandatory or optional (also called free choice). And as exclusion criteria, the OHN subject, even though it exists in the curriculum, was not offered during the course under analysis. In this table, it was recorded whether the OHN and/or OHM was mandatory or optional (none was basic or core), the number of European Credit Transfer System (ECTS) of each subject, and the course when it was taught (of the four years from the Nursing Degree, and the six from the Medicine Degree). For every center whose study plans were selected, the official websites of the faculties and/or the teaching guides were viewed, as well as the study plan bulletin in those of recent implementation.

Finally, another table was created that included the subjects identified as mandatory for OHN and OHM, with the subjects names.

3. Results

3.1. A total of 35 centres with Nursing and 30 with Medicine Degrees from Spanish universities, both public and private, were selected as a sample.

Table numer 1 shows the results obtained regarding subjects on OHN and/or OHM, or occupational health, or occupational risk prevention, or similar terms, offered during the 2024-2025 academic year in Spain. Of the total Nursing study plans analyzed, 60% offered subjects on OHN, while 27% did it in Medicine Degrees (excluding the five universities that did not offer Medicine). None of the studied centers offered it as core o basic training, with only 6% offering it as mandatory in the Nursing Degrees, and 3% in the Medicine ones. These percentages did not include those centers that, as in the case with the Nursing Degree at the University of the Balearic Islands, mention it among electives “occupational health” with 3 ECTS but not the offer during the academic course under study. Neither the case of the Huelva University in its brand new Medicine Degree, which will offer a mandatory subject called “Occupational and Environmental Health” for the 2026-2027 academic year.

Regarding nomenclature, most of the names included the terms “occupational health”, “prevention”, “occupational risks” for Nursing, and “occupational health”, “legal”, “environmental” for Medicine Degrees. Others were included in subjects with different names: “Occupational risks and environmental toxicology”, “Prevention of occupational risks in the health field”, “School and workplace nursing”, “Nursing care in the educational and work field”, “Guidances for nursing specialties”, “Legislation, management and occupational health”, “Legal medicine and occupational health”, etc. although there were centers that named it according to the corresponding specialty: OHN, OHM, although none of the Medical Degrees in the selected centers offered it as mandatory.

In relation to the number of ECTS credits, the statistical mode was 6 ECTS (9 centers), followed by 3 ECTS (7 centers), 4.5 ECTS (3 centers) and 4 ECTS (2 centers) for the Nursing Degree subjects, being 3 ECTS (5 centers) the mode for the studied Medicine Degrees. Regarding the most frequent course in which they were taught, the last courses predominated, 3rd and especially 4th in the Nursing Degrees, and 5th year in the selected Medicine ones.

Table 1. Subjects on OHN / OHM or related terms in Nursing/Medicine Degrees in Spanish Universities during 2024-2025 academic year. Non Grade indicates that there is no Faculty of Medicine (*) See Table 2.

2024-2025 ACADEMIC UNIVERSITY	NURSING DEGREE OHN YES/NO (ECTS Credits)	ACADEMIC COURSE (OPTIONAL/ MANDATORY) IN NURSING	MEDICINE DEGREE OHM YES/NO (ECTS Credits)	ACADEMIC COURSE (OPTIONAL/ MANDATORY) IN MEDICINE
A CORUÑA	YES (6)	3º (OPTIONAL)	NON-GRADE	NON-GRADE
ALFONSO X EL SABIO	YES (4)	4º (OPTIONAL)	NO	

ALMERÍA	YES (3)	4º (OPTIONAL)	NO	
ANTONIO DE NEBRIJA	YES (3)	4º (OPTIONAL)	NO	
AUTONOMA BARCELONA	NO		NO	
CADIZ	NO		NO	
CANTABRIA	NO		NO	
CASTILLA-LA MANCHA	YES (6)	3º (OPTIONAL)	SI (6)	6º (MANDATORY)
CEU SAN PABLO	NO		SI (3)	5º (OPTIONAL)
COMPLUTENSE MADRID	YES (6)	3º (MANDATORY)	NO	
CÓRDOBA	SI (3)	3º (MANDATORY)	NO	
DEUSTO	YES (4)	2º(OPTIONAL)	NO	
EUROPEA M. CERVANTES	YES (3)	4º (OPTIONAL)	NON-GRADE	NON-GRADE
EXTREMADURA	SI (6)	3º (OPTIONAL)	NO	
GRANADA	NO		NO	
HUELVA	YES (6)	4º (OPTIONAL)	NO	(*)
ILLES BALEARS	NO		NO	
JAÉN	YES (6)	4º (OPTIONAL)	NO	
JAUME I CASTELLÓN	NO		NO	
LA LAGUNA TENERIFE	NO		NO	
LA RIOJA	YES (3)	3º (OPTIONAL)	NON-GRADE	NON-GRADE
LAS PALMAS DE GC	NO		NO	
LEÓN	YES (3)	3º (OPTIONAL)	NON-GRADE	NON-GRADE
LLEIDA	YES (6)	4º (OPTIONAL)	NO	
MURCIA	NO		NO	
OVIEDO	YES (6)	4º (OPTIONAL)	SI (3)	2º (OPTIONAL)
PAIS VASCO	YES (4.5)	3º (OPTIONAL)	NO	
SALAMANCA	SI (3)	4º (OPTIONAL)	SI (3)	6º (OPTIONAL)
SANTIAGO COMPOSTELA	YES (4.5)	2º (OPTIONAL)	SI (3)	5º (OPTIONAL)
SEVILLA (US)	NO		NO	
VALENCIA	YES (4.5)	4º (OPTIONAL)	SI (4.5)	3º OPTIONAL
VALLADOLID	NO		SI (3)	5º (OPTIONAL)
VIC	NO		SI (5)	3º-6º (OPTIONAL)
VIGO	SI (6)	4º (OPTIONAL)	NO	NON-GRADE
ZARAGOZA	NO		SI (5)	5º (OPTIONAL)

3.2. Table number 2 shows the Universities and Degrees that offer, in their study plans, mandatory subjects, with their name, about OHN and/or OHM. It stands out that only one University has a specific name on OHN, while the rest include terms of “legislation/legal”, “environmental”, “management”, in addition to “occupational health”. Most consist of 6 ECTS credits and are offered to be taught during the third year of the corresponding university degree.

Table 2. Universities and Degrees that offer mandatory subjects on OHN / OHM in their study plans,.with the subjects name.

UNIVERSITY	ACADEMIC YEAR	SUBJECT NAME IN THE NURSING DEGREE	ECTS Credits (COURSE IN WHICH IS TAUGHT)	SUBJECT NAME IN THE MEDICINE DEGREE
CASTILLA LA MANCHA	2024-2025		6 ECTS (6 ^º)	LEGAL MEDICINE AND OCCUPATIONAL HEALTH
COMPLUTENSE DE MADRID	2024-2025	LEGISLATION, MANAGEMENT AND OCCUPATIONAL HEALTH NURSING	6 ECTS (3 ^º)	
CÓRDOBA	2024-2025	OCCUPATIONAL HEALTH NURSING	3 ECTS (3 ^º)	
HUELVA ^(*)	2026-2027		6 ECTS (3 ^º)	OCCUPATIONAL AND ENVIRONMENTAL HEALTH

3.3. Table number 3 illustrates the distribution of subjectos of the Nursing Degree of the University that offered, as mandatory and specific, OHN during the third year of the Degree (second semester), with 3 ECTS credits.

Table 3. Distribution of subjects of the University Nursing Degree with specific and mandatory on OHN during the 2024-2025 academic year. (+) Similar term to the corresponding nursing specialty.

FIRST SEMESTER	CREDITS
MENTAL HEALTH NURSING (+)	6
ADULTO NURSING II	6
GERIATRIC NURSING (+)	6
FAMILY AND COMMUNITY NURSING (+)	6
TWO OPTIONALS TO CHOOSE	6
TOTAL	30
SECOND SEMESTER	CREDITS
ADVANCED CLINICAL NURSING, CRITICAL CARE AND PALITATIVE CARE	6
NURSING RESEARCH ON CARE AND QUALITY OF LIVE	3
OCCUPATIONAL HEALTH NURSING (+)	3
PRACTICUM II - COMMUNITY	9
PRACTICUM III - COMMUNITY	9
TOTAL	30

4. Discussion

The aim of this manuscript was to review and update the situation of OHN as a mandatory subject in Nursing Degrees and its comparison with that OHM in Medicine Degrees at Spanish universities. From the results obtained, the scarce implementation of both is striking, since, during the 2024-2025 academic year, only two universities include it as mandatory in their degree study plans of Nursing, and only one does so in the degree of Medicine, although another one has been identified which is planned for the future [27].

Regarding university degrees in Medicine, comparing the results obtained in university centers that offered specific subjects (OHM) or related (“prevention of professional/catastrophe risks”) with those of the article published by Lopez et al in 2007 [21], the number of OHM subjects has decreased after more than fifteen years. Data in line with Ramada and Nohales article [28], who mention that, despite the clinical, preventive and social relevance that emanates from the WHO definition, OHM and OHN are disciplines absent or barely present in the training plans for Medicine or Nursing Degrees at Spanish universities, with honorable exceptions [28]. These authors ask themselves in their article, when will there be a letter to the National Conference of Deans of Nursing and Medical Spanish Faculties explaining the curricular deficiencies in occupational health of graduates in Medicine and Nursing [28]. The situation years later remains practically the same, as stated in a recent editorial [29] indicating that the new training specialist do not have prior knowledge of the specialty in the degree, because OHM is not found in the vast majority of their teaching plans [29]. This may be one of the factors that explains the low demand that OHM has in the choice of medical specialties after the Spanish MIR exam, since as Fernández-Montero states [30], the low presence in the Medical Degree favors a lack of knowledge of the specialty both students and by the doctors themselves, generating little interest when choosing the OHM specialty [30]. An issue that has been reflected in successive years with the choice of OHM and OHN specialties in the last positions of the places offered for MIR and EIR exams [28].

The results obtained (Table 1) show that the current reality is not much better for the Nursing Degree, confirming the low implementation of OHN as a mandatory and/or specific subject in university undergraduate studies in Spain. Facts that also seem to occur in Europe, where there are few countries that offer mandatory subjects on occupational health in their university degree studies [19]. Whitaker describes, in his study carried out in the UK, a worrying decline in the teaching of occupational health at the undergraduate level of medical students. And this, despite the fact that Brown et al already recommended in 1976, to make a concerted effort to include specific OHN components in the curriculum of nursing school curricula, given the decline in education funding, and the need for curriculum changes in nursing education [31]. However, there are authors who prefer OHN as master studies [9]. In fact, in countries like Portugal they are nursing specialization studies [32], and in France an inter-university Diploma is necessary to practice, from 2023, as an OHN [33]. There are also countries that combine it with Masters programs for specialization of graduated nurses [3], some of which do so through an educational outreach with blended model [34].

Returning to the results of the study (Tables 1 and 2), in the Nursing degrees analyzed, there is only one university that offers OHN as a mandatory and specific subject accordingly with the same as the nurse specialty [14], responding to the demand that nursing should start from minimal notions about the subject, allowing it to delve deeper into it, since specialization cannot be conceived without a prior base [14]. The rest of the university centers analyzed in the study propose the occupational subject with other legislation and/or management or other content. This fact is not trivial, since, for example, in the field of medicine, “legal” constitutes a specialty with its own corpus, therefore subtracting the importance of nursing and/or occupational medicine. Hence, in addition to being mandatory, the subject nomenclature in question is an issue to be considered. In this sense, the term “occupational health” can facilitate this relevance, which is observed in a percentage of the optional subjects found, but it takes away its prominence when it appears together with other denominations (“toxicology”, for example), or as part of other subjects that phagocytize it, such as those of community nursing, epidemiology and/or public health, which also constitute their own and different nursing and/or medical specialties in Spain. Being part of the public health subject also occurs in other countries. The Annual Meeting of the American Public Health Association cited in the introduction [7] already demonstrated this. Brown cited in 1976 that OHN content was taught primarily by Public Health nurse faculty in Public Health nursing courses [31]. Also Esin, who mentioned in his observational study with all nursing faculties in Turkey that OHN topics were covered in public health courses at all schools [35]. Therefore, a modification of the curriculum in nursing degrees could be proposed. In Spain, Amores-Lizcano et al [19] mention the need, for the

development of OHN, to unify the training plans for nursing degree. This question about of a standardized education programme is requested by Esin for Türkiye too [35]. In this sense, the curricular proposal shown in the results (Table 3) is also innovative as long as the rest of the Spanish nursing specialties as also included as mandatory subjects: mental health nursing, geriatric nursing, family and community nursing, obstetrical-gynecological nursing, and pediatric nursing [14, 36]. This proposal would be like a “common minimum” that most of Nursing degrees at Spanish universities could offer. Standardization that would imply a challenge given the freedom that university centers have to configure their study plans [19], and also at an international level, since, for example compared to the five OHN areas of practice that exist in Spain [18], the Australian College of Occupational Health Nursing establishes eight competency standards [37]. In this line of argument, the literature reviewed confirms that the training and OHN curricular contents at the undergraduate level continue to be heterogeneous both in Spain and internationally. Delclos et al mention the worldwide differences in skills and curricula between OHM specialists, OHN ones, industrial hygienists and ergonomists [38]. Also in Japan, where the curriculum for the industrial health nurses degree are developed at the discretion of each university [39]. And in Latinamerica, as shown by the heterogeneity found by Valencia et al in their study developed in Brazil, Chile, Colombia and Mexico [11]. In fact, the homologation of postgraduate Nursin specialties at European level is already a challenge, despite the call to attention of an article published a decade ago [15]. And even more so, if we find such varied terms in the same field of occupational health as, for example, occupational health nurse consultants, occupational health nurse educators, certified occupational health nurses, or industrial hygienist [31]. In this sense, core competencies for UK OHN, as proposed by Laloo et al in their Delphi study [40], or those proposed by Metin and Yildiz in Turkey [41], could help in this regard, who also identified a set of significant professional competences for the practice of OHN that should be included in the specific training programs, such as expanding its content in undergraduate education regarding taking detailed occupational history, performing basic laboratory tests, interpreting laboratory results, research methods, and participation in policies and management [41]. What most of the reviewed literature agrees on is the need for OHN courses to be integrated into the curriculum of undergraduated programs [42]. In this sense, McCullagh et al [43] introduce an innovative OHN curriculum for students enrolled in baccalaureate nursing programs from UK concluding that the inclusion of occupational health nursing content in basic nursing education is of interest both nurse educators and clinicians, preparing professional nurses to understand the role of the OHN and the relationship between work and health is an essential curricular consideration for contemporary nursing education. Accordingly to this idea, the teaching guide for the mandatory subject of OHN mentioned in Table 3 [44] is based on the competences established in the homonymous specialty training program [14], developing its own contents. In this way, the vision offered by many of the optional subjects identified in this review is expanded, because most of them tend to focus on the prevention of occupational risks in the healthcare field, and/or on the risks associated with the nursing profession. Accordingly to this Whitaker mentions that most of the teaching is integrated within other modules, not specifically related to occupational health, and is generally directed towards covering subjects such as the risks to the nurses own health and safety [45]. The contents of the mandatory and specific subject referred to also offer some innovations both in its methodology and its contents. In methodology regarding the use of clinical simulation, according to Yoshioka et al., who mentions better self-confidence scores for health guidance skills for adult occupational health nursing, so high-fidelity simulation focused on health guidance can bridge the gap between theoretical knowledge and practice of students [46]. Also in content, by incorporating indications on drugs used to address smoking from nursing [44]. There are innovations on OHN in the literatura, such as that of Lovan & Jones, with the goal of exposing students to workplace health risks associated with diverse occupations [47]; or about learning OHN through conferences, audiovisuals and expert teaching in this field [3], or asynchronous and synchronous continuing education that covers a range of OHN topics [48]. However, the innovation presented here is structural, as it is consolidated in the university undergraduate study curriculum in nursing.

On the other hand, the results of the study showed that the mode in the number of ECTS credits for OHN or related subjects was 6 ECTS in nursing degrees, and 3 ECTS en Medicine ones. It is striking that they are different as well as the greater teaching weight of subjects that correspond to other nursing specialties (table 3), coinciding with what was expressed in other article [19]. Nevertheless, it is a first step to give OHN the importance it deserves. Regarding the degree course in which they are offered, in both university degrees, the last courses predominated, as occurs in Latinamerica where the majority of the centers that offer OHN were taught in the last years of training with a predominance of elective courses [11].

To our knowledge, this is the first article that analyzes and compares occupational health subjects in nursing and medicine degrees through a representative sample (25, 26) in Spain. Another study, carried out in the UK on both, by Lalloo et al, in which they compare the competencies between doctors and occupational nurses, reports a very high level of agreement on the identified competencies, with the same principle domains featuring in the top four and bottom three ranks. These mutually indentified priorities can strengthen collaboration between these groups and identify common professional development and education opportunities for their respective governing bodies [49]. An example of integration is the so called Multiprofessional Occupational Health Teaching Unit that exists in Spain, which includes both nurses and physicians specializing in occupational health training.

Occupational health is a capital aspect. According to Fuller, millions of people are injured and killed each year while they are working, and many of these injuries and deaths are due to inadequate training education in occupational safety and health [50]. This data justifies that there should be mandatory and specific occupational health subjects in nursing and medicine degrees. But, another argument is the number of working people around the world and their impact on health. As indicated by Staun OHN not only ensure the health of workers, but also contribute positively to productivity, the quality of products, work motivation, job satisfaction, and the overall quality of life of individuals and society [51]. Its absence constitutes an obstacle facing the Occupational Safety and Health profession in providing safe and healthy workplaces globally while its widespread presence would increase the prestige, recognition and scientific quality of the specialty [30]. It would also facilitate the creation of university teaching positions linked to health services, which currently do not exist for occupational health specialists.

This work is limited by the possibility of not having included any of the private universities that have proliferated in Spain in recent years. Future similar studies in Europe would facilitate knowledge of the reality of OHN in universities both public and private, internationally.

5. Conclusions

The innovative proposal on the incorporation of a mandatory and specific of OHN shown in this study, along with other subjects, also mandatory, associated with official nursing specialties, could serve as a model for its incorporation into plans of Spanish nursing studies, and a firm step towards the widespread implementation of occupational health in nursing and/or medicine degrees, a milestone that would favor social recognition and progress in the scientific development of the corresponding specialties.

Author Contributions: For research articles with several authors, a short paragraph specifying their individual contributions must be provided. The following statements should be used “Conceptualization, A.R.S; methodology, A.R.S and E.M.; software, A.R.S., R.C.M. and M.R.S.; validation, A.R.S., E.M., R.C.M. and M.R.S; formal analysis A.R.S.; investigation, A.R.S and E.M; resources A.R.S., R.C.M. and M.R.S.; data curation A.R.S and E.M; writing—original draft preparation, A.R.S and E.M; writing—review and editing, A.R.S and E.M; visualization, A.R.S., E.M., R.C.M. and M.R.S; supervision A.R.S., E.M., R.C.M. and M.R.S.; project administration, A.R.S; funding acquisition, A.R.S. All authors have read and agreed to the published version of the manuscript.” Please turn to the CRediT taxonomy for the term explanation. Authorship must be limited to those who have contributed substantially to the work reported.

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