




**Please cite the Published Version**

Verran, J , Illingworth, S, Pritchett, J  and Redfern, J  (2023) Co-development, co-delivery, and evaluation of a Medical Writing module at master's level. *Medical Writing*, 32 (1). pp. 92-98. ISSN 2047-4806

**DOI:** <https://doi.org/10.56012/lbmg8046>

**Publisher:** European Medical Writers Association

**Version:** Published Version

**Downloaded from:** <https://e-space.mmu.ac.uk/632367/>

**Usage rights:**  In Copyright

**Additional Information:** This is an Open Access article published in *Medical Writing*, by European Medical Writers Association.

**Enquiries:**

If you have questions about this document, contact [openresearch@mmu.ac.uk](mailto:openresearch@mmu.ac.uk). Please include the URL of the record in e-space. If you believe that your, or a third party's rights have been compromised through this document please see our Take Down policy (available from <https://www.mmu.ac.uk/library/using-the-library/policies-and-guidelines>)

# Teaching Medical Writing

SECTION EDITOR



Claire Gudex

cgudex@health.sdu.dk

Few universities offer courses in medical writing, and students from the biomedical sciences who wish to become medical writers typically need to learn written communication skills on the job. These skills are extremely varied and include:

- Critical analysis of data in scientific reports and publications
- Appropriate synthesis of large amounts of information from diverse sources
- Ability to write well-structured texts that

are clear, accurate, and grammatically correct

- Understanding the needs of different target audiences
- Awareness of legal and ethical issues such as transparency and plagiarism.

It would be hugely advantageous to learn these skills through an accredited university course that enabled discussion, collaboration, and review of each other's texts.

In this article, Joanna Verran and colleagues

provide a fascinating insight into the opportunities and challenges when establishing a Medical Writing course at postgraduate level. The course is particularly interesting due to its development through a collaboration between the university and representatives from MedComms companies.

Happy Reading!

Claire

## Co-development, co-delivery, and evaluation of a Medical Writing module at master's level

Joanna Verran<sup>1</sup>, Sam Illingworth<sup>2</sup>,  
James Pritchett<sup>1</sup>, James Redfern<sup>3</sup>

<sup>1</sup> Department of Life Sciences, Manchester Metropolitan University,

<sup>2</sup> Department of Learning and Teaching Enhancement, Edinburgh Napier University

<sup>3</sup> Department of Natural Sciences, Manchester Metropolitan University

Correspondence to:

Joanna Verran

j.verran@mmu.ac.uk

doi: 10.56012/lbsg8046

### Introduction

The introduction of an MSc in Science Communication at Manchester Metropolitan University, UK, provided the opportunity to co-develop and co-deliver a Medical Writing module with representatives from a range of MedComms companies. This module was included as an option within the MSc programme. Student feedback was good, and most of the students who took the module gained employment within the industry. The development process, content, delivery, assessment, evaluation, and the future of the module are addressed in this article.

In a jobs-focused university environment, it is important that students learn not only the

appropriate skills but also the relevant knowledge of potential employers.<sup>1</sup> For students of the biomedical sciences, obvious post-graduation routes include the professionally accredited biomedical science routes for teaching, research, and laboratory-focused work within academia and the pharmaceutical, food, environmental, and other industries.<sup>2</sup> However, the world of medical communications (MedComms) is far from the typical science graduate experience.

As university academics, we were aware of MedComms professions primarily through employment of our past PhD students. We noted how these students brought their science literacy, knowledge, expertise, and skills to a career beyond the laboratory. We felt that we, in turn, should bring this important employment opportunity to a wider student audience.

Increasing numbers of universities are offering master's courses in Science Communication.<sup>3</sup> Each of these tends to focus on the specialist expertise offered by the host university, thus it is important to be able to market an "angle" to attract applicants to a given course.

At Manchester Metropolitan University (MMU), in addition to an active team delivering events and activities designed to enhance public understanding of science, a healthy research-

focused publication output on science communication is evident.<sup>4-6</sup> Cross-disciplinary collaboration between the humanities and the sciences is also well-established,<sup>7-10</sup> enabling the development of an Art and Science module within a new MSc in Science Communication. The Department of Life Sciences within the Faculty of Science and Engineering has a large and very well-respected Biomedical Science

research and teaching (undergraduate and postgraduate) portfolio, which facilitated the development of a unique Medical Writing module. Thus, a new MSc in Science Communication was devised, incorporating these particular areas of expertise alongside more fundamental aspects of the discipline.

This paper describes how we brought together our higher education expertise with the expertise of the MedComms profession to develop and deliver a postgraduate module in Medical Writing. This module was part of the MSc in Science Communication, but it was also offered as a standalone module for interested individuals.

### Course approval

To deliver a new university course, the staff proposing it are required to demonstrate a need/demand (thus attracting students and

Increasing numbers of universities are offering master's courses in Science Communication.



securing funding) and the availability of appropriate expertise and staff time for delivery, preferably accompanied by letters of support from various stakeholders. In developing the MSc, the Science Communications team at MMU used a student intern to conduct some market research on likely recruitment, which highlighted the proposed module in Medical Writing as one of the unique selling points for such a course. The course proposal was approved through the formal university procedure, and development went ahead.

The MSc was designed to be delivered over 12 months full-time (or 24 months part-time) and consisted of four 30-credit modules and one 60-credit module (Figure 1). Students were given the option of picking one module from either Science Journalism, Medical Writing, or SciArt, depending on the area they wished to specialise

in. The Medical Writing module is the focus of this paper.

### Module development

It was essential that the MedComms community both supported the module and could provide input into it, so a network was assembled – initially via contact with ex-students and other colleagues working in the area, thence to the European Medical Writers Association (EMWA), the International Society for Medical Publication Professionals (ISMPP), and Network Pharma. A presentation was given at the EMWA meeting in 2016 to raise awareness of the course and module, followed by a call from Network Pharma. It is fortunate that the Northwest of England is home to a large number of pharma companies, but it is also fantastic how many companies and individuals from other regions of

the country became such committed collaborators in this new venture. (Several contacts provided letters of support for submission to the course approval committee, and while some reservations were expressed regarding the academic level of the course – recruitment tends to be at PhD level rather than master’s level – all were willing to explore the option.)

Ultimately, 19 representatives from 18 different companies became the industrial liaison team, alongside the four university academics (and authors of this paper) who formed the course management team. After initial contact had been made, the industrial partners were provided with the course objectives, learning outcomes, assessments, and indicative content of the Medical Writing module that had been used to obtain preliminary course approval (Figure 2). They were asked to help develop these with more



**Figure 1. The modules for the MSc Science Communication course**

The three blue modules were each worth 30 credits, and the yellow module (“Live Projects”) was worth 60 credits. Students then chose one 30-credit green module (Science Journalism, Medical Writing, or SciArt). Practical Science Communication and a “green” module were delivered in Term 1; Science Communication as an Academic Discipline and Science and Society were delivered in Term 2; the live project took place during the remainder of the academic year.

Session	Topic	Staff	Indicative content
Enrol	MedComms Conference <sup>a</sup> (open attendance)		
L1	The World of Medical Writing	A <sup>b</sup> /I	Brief overview of medical communications from industrial partners, outlining some of the different routes through the profession, commercial considerations, and giving an overview of desirable employee attributes. Consideration will be given to how to manage a project from initiation to final sign-off.
S1	Preparation for Assignments	A	Assignment requirements and recommendations will be outlined. Introductions via a personal statement, and as a beginning to CV/portfolio development. This written work will also be collected in and edited if appropriate. Editing exercise.
L2	Clinical Development Process I	I	An overview of the clinical development process – including pre-clinical stages – as underpinning information to support understanding of the profession. Pharmacokinetics refresher.
S2	Digital Comms	A	Digital communications. Online publishing. LinkedIn, Twitter, etc. Portfolio/reflective diaries.
L3	Clinical Development Process II	I	Outline of overall process, with illustrative examples. Marketing access (pricing, reimbursement), as well as marketing approval, and phase 4 post-marketing, pharmacovigilance, and real-world observational studies.
S3	Clinical Development Activity	I	Activities illustrating clinical development process.
L4	Writing Good English	A	The value of writing well, and the principles of basic English and grammar (University Language Centre). Consideration as to how all interactions with others contribute to an impression of professionalism (emails, webex, telephone).
S4	Writing for Different Audiences	A	The different ways in which English might be used to communicate information around medical research (social media, press, narrative) to a range of different audiences.
L5	Core Medical Writing Skills I	I	The conventions of scientific writing, and how to read, abstract, and present scientific/technical information in writing. The session will include reference management, abstracting information, writing abstracts, working to time constraints. Introduction to typical expectations of a project brief and subsequent outputs, and the role in setting standards of relevant professional groups such as ISMPP, EMWA. Guidelines for manuscript preparation, and reporting of different types of clinical data as provided by the EQUATOR network. Good publication practice guidelines (GPP) and reporting guidelines (e.g., CONSORT).
S5	The Craft of Copywriting	I	In this externally led session, tips, tricks, and exercises to hone your writing skills and make your copy compelling and irresistible to read will be given.
L6	Core Medical Writing Skills II: Information retrieval and management	A	The range of information resources available, including core medical writing resources – journals, papers, website, databases, textbooks (with University Library)
S6	Assignment one workshop	A	
L7	Statistics and Presentation of Data I	A	A refresher on the basic statistical analyses used in clinical research, to help understanding and interpretation of results.
S7	Statistics and Presentation of Data II	A	How best to present information derived from clinical data, including digital channels, PowerPoint, Prezi, Keynote, tables, infographics, etc.

Session	Topic	Staff	Indicative content
L8	Clinical Studies: Interpretation and presentation of clinical data	A	Bringing previous topics together with examples and exercises.
S8	Assignment workshop		
	Assignment one deadline		
L9	Professional Standards: Constraints and Compliance	I	The context within which the profession operates, including the need to focus on good publication practice, adverse event reporting, copyright infringement, plagiarism, data protection, etc. as well as business ethics, professionalism, and responsibility. Regulatory bodies/guidelines such as EFPIA, ABPI, ICMJE, GPP3, Sunshine Act, EQUATOR Network.
S9	Case Studies	I	Different case studies which raise issues around constraints and compliance (e.g., authorship, disclosure, copyright, plagiarism, ethics, code of conduct) will be provided for consideration and discussion.
L10	Communicating with different audiences	I	A different look at how audiences perceive and understand modes of communication.
S10	Assignment two workshop	A	
	Placement week		
L11	Understanding new therapy areas	A/I	Introduction to relevant hot topics by healthcare science researchers at the University, and consideration as to how information around these topics can be converted into appropriate resources, for different audiences such as specialists, healthcare providers, internal pharma, patients, etc. A request for proposals (RFP) will be provided for students to present during Thursday's session, with a Q&A session to help clarify the RFP.
S11	Responding to a brief: Student presentations	A/I	Students make a pitch, with up to five slides (or no slides) in a "Dragons Den" format on the basis of Tuesday's RFP
L12	One-to-one tutorials	A	
	Professionalism	I	Writing test, CV surgery, careers overview, Q&A

**Table 1. The structure and indicative content of the Medical Writing module within the MSc Science Communication at Manchester Metropolitan University**

Week numbers 1–12 are designated L=Lecture or S=Seminar. A range of student-centred activities took place throughout the lecture and seminar slots.

a The conference/event was organised by Network Pharma and hosted by the University of Manchester.

b A member of the academic staff (A) was in attendance at all sessions. Joint delivery (A/I) is specified. Other sessions were led/delivered by representatives from Industry (I).

Abbreviations: ISMPP, International Society for Medical Publication Professionals; EFPIA, European Federation of Pharmaceutical Industries and Associations; ABPI, Association of the British Pharmaceutical Industry; ICMJE, International Committee of Medical Journal Editors; GPP3, Good Publication Practice 3; EQUATOR, Enhancing the QUALity and Transparency of health Research.

detailed suggestions regarding content. This preliminary information and feedback were used during an "awayday" where the module structure was built. At this developmental meeting, participants were informed as follows:

"At this meeting, we will outline the overall course aims, content, and learning objectives so that you will be able to see

the context in which the Medical Writing route will operate. For the Medical Writing module, we will consider content, delivery methods, formative, and summative assessments. There will also be opportunity to consolidate the relationship between this module and the live project."

The format of the day comprised morning and afternoon breakout sessions followed by pooling of ideas and iterative construction of the module in terms of content, sequence, student activity, and assessment. Information that industrial partners provided prior to the awayday proved particularly useful to the academic staff in terms of the wide-ranging scope of desirable and

# Module description

This module will introduce you to medical writing as a profession and provide you with the skills and knowledge that are necessary for a career within a medical communications provider/agency – as well as for a range of other professions requiring excellent communication skills.

The curriculum will cover:

- The interpretation of clinical data and the critical analysis of publications containing such data
- An overview of the industry and profession
- The legal framework within which the industry operates

- An overview of the different audiences towards which medical communications are aimed
- Effective, accurate, and grammatically correct writing of scientific/medical content to a brief, aimed at scientifically literate audiences encompassing journal publication, conferences, print publications, digital publication, video, and audio content.

This module has been designed in conjunction with a number of medical communications companies, meaning that upon graduation students that have elected to study this module will be extremely well placed in terms of

employment prospects in medical communications.

## Learning outcomes

On successful completion of this module, you will be able to:

1. Assess the scientific importance of clinical research outputs with reference to the effectiveness of pharmaceutical products;
2. Distinguish between the needs and requirements of different audiences and delivery platforms/methods when writing medical communications;
3. Compose a piece of evaluative medical writing, written to a brief.

### (ASSIGNMENT 1):

#### Report on clinical paper (30% of total assessment mark)

You will be given more detailed instructions at the beginning of the course.

You must critically analyse the scientific content within a journal publication containing clinical data relating to the development of a pharmaceutical product. This might be suggested to you by a tutor, or an industrial partner, or you might identify your own publication (and seek tutor agreement for appropriateness). From this, you will produce a report detailing:

- An overview of the therapeutic area
- A consideration of existing drugs used in this therapeutic area
- An analysis of the drug under development, including a consideration of the evidence for its efficacy
- The therapy area, the range of drugs already on the market, and the product that the data are supporting
- An analysis of the scientific evidence.

### (ASSIGNMENT 2):

#### Portfolio (70% of total assessment mark)

You will be given more detailed instructions at the beginning of the course.

Create a portfolio of medical communications/writing that has been constructed to a brief, based on a clinical research paper regarding a pharmaceutical product. You will be expected to:

- Critically analyse the publication
- Reconstruct the data into one or more elements of communication for a range of target audiences, e.g. clinicians, nurses, patients etc.
- Discuss your approach to different styles of writing for each of the elements and target audiences
- Ensure that all elements produced meet the legal and ethical framework within which UK medical writing must comply.

Figure 2. An extract from the student handbook, providing an overview of the Medical Writing module

essential skills required.

Free and open discussion enabled the development of a module with which all participants were satisfied – one that was sufficiently rigorous for master's level, had assessments appropriate to module aims, and encompassed a broad overview of the MedComms industry and the scientific writing and presentation skills necessary. A summary of the discussion and the module structure was circulated for comment. This was then refined over a couple of months so that the module was deemed satisfactory by all participants and was ready for delivery (Table 1).

Representatives from different companies took ownership for different sessions (often companies shared delivery). Indeed, several of the awayday participants noted how enjoyable it was to work with colleagues from other companies. Additional benefits were the collaboration with university academics and the opportunity to formally become "Associate Lecturers".

## Module delivery and evaluation

The course was advertised through the usual university postgraduate portfolio (including a video) and at recruitment open days. Advertise-

ments were also circulated via Network Pharma. The first cohort on the Medical Writing module comprised four students, of which one was taking the course part-time, and another (PhD student) was taking the module as a free-standing unit. The remainder were recent graduates. The second cohort comprised seven students (more students registered for the MSc overall for both cohorts, but numbers were low overall; the Science and Art module option was selected by all other students).

The Medical Writing module was delivered over one semester (12 weeks) for five hours per



week (three hours of lecture-based sessions and workshops on a Tuesday, and two hours of seminar-focused interactive sessions on a Thursday).

Every session was attended by a member of the academic staff. (The first cohort was attended by author Joanna Verran; the second cohort by author James Pritchett) to provide continuity and to observe and learn further about the profession. Communication within the industrial liaison team was regular and frequent.

Student attendance was excellent; it seemed evident to the students that such an intensive module required commitment. Industrial partners who delivered sessions noted that student participation was initially poor – there seemed to be some reticence to join discussion in a small group – but this improved as the module progressed and students gained confidence. There was also interesting crossover for some companies as they learned more about the course overall. For example, the SciArt module exhibition showcased students with overt artistic talents that enabled additional collaboration<sup>11</sup> (see e.g. Figure 3).

Summative assessments were supported throughout the module by formative assessments and other exercises. Tutorials and workshops also provided support for assignments. A particular success of the module was the work placement week, for which students were required to research the partner companies, select two where they wanted to work, and write an application



**Figure 3. Artist Tony Pickering collaborated with St Giles Med to showcase his experiences with type 1 diabetes.**

letter. This was fairly intensive work for the academic placement tutor (and would have been very significant with a larger student cohort). A particularly (intentionally) stressful session was the “responding to a brief” event, where students had to translate research presentations from university researchers into pitches for drug marketing within 48 hours.

Student evaluation was detailed and constructive, enabling the industrial liaison team to review the delivery of the module and make any appropriate modifications. The students were keen for even more opportunities to practise writing for different audiences.

Summative assessments were supported throughout the module by formative assessments and other exercises.

### Outcomes

For the first cohort of students, all were employed by a pharmaceutical company within six months of graduation, predominantly by the company in which they had undertaken their work experience. Feedback from the students was very positive.

One noted:

“Before I started my MSc in Science Communication and Medical Writing submodule, I was completely unaware of the Med Comms industry that I now find myself in.

During the course I learnt how to transform complex science into understandable information for a variety of different audiences. This came in useful during my live project, where I conducted a narrative review into methods of reflection for medical students.

Since then, I’ve worked at two Med Comms companies, in Europe and London, and authored a publication. A big ‘Thanks’ goes out to the course leaders for giving me the tools to achieve this!”

And another:

“The MedComms module has hugely benefitted my career by providing a strong foundation on which to develop my skills ahead of beginning my career in MedComms. I was grateful for the depth of information and insights provided about all aspects of working on MedComms, and for the opportunity to hear from different lecturers and speakers who provided their own working experience and direct guidance, which may not always be available for those just starting out in MedComms as many scientific graduates may not have heard of MedComms careers during their studies. I am now happily working in MedComms.”

Some of the students chose to do their Live Project in collaboration with one of the companies, with a university supervisor to guide the academic dimensions and ensure that learning objectives were met. In addition to the overall grades of the module, there were further benefits in that some of the students presented their work at conferences, and others had their work published in peer-reviewed journals (students Clausi and Silvagnoli<sup>12–14</sup>).

Despite these successes, the MSc Science Communication was unfortunately discontinued after two iterations, primarily because low student numbers made it unsustainable. Poor recruitment may have resulted from difficulties in marketing the course to the appropriate target audience, amongst competition from other more well-known postgraduate routes. The academic and industrial liaison team subsequently considered the possibility of developing an online module/course based on and further developing the experience from the Medical Writing module, but this did not progress.

Despite the discontinuation of the module, the delivery team considered that the collaborative design, delivery, and evaluation, combined with the evident academic and professional success of the students, merited dissemination. This was the motivation for writing this paper. There are other avenues for training in medical writing – EMWA and several pharma companies provide various training units or open access modules to prepare potential applicants/update existing employees. Some universities offer Medical Writing courses,<sup>15–16</sup> but these are few. It is therefore hoped that the lessons learned, and the content developed, may help others who are thinking about designing courses to educate students in the world of medical writing.

### Summary: Lessons learned

- University accreditation and validation procedures provide appropriate rigour and robust evidence of learning at master’s level.
- Collaboration between university and industry is essential for module development and delivery, and it is highly enjoyable and enlightening.
- Students respond well to a Medical Writing module, and they are eminently employable in the field.
- The module is costly in terms of staff time (university and industry), irrespective of student numbers, and face-to-face delivery requires several lecturers with different expertise each time the course is run.
- It is essential that advertising and marketing

reaches the intended audience.

- All stakeholders need to be committed to maintain delivery and ensure sustainability of the module over time.
- We consider that the module development, content, delivery, assessment and evaluation described herein is an example of good practice.
- There is potential for online delivery of an accredited module.

## Acknowledgements

The authors would like to thank all the individuals and companies who worked with us to design and deliver this module. We have tried to contact all those individuals, and have received some responses, but we recognise that personnel move on and companies change names! Nevertheless, we felt that we should list the names of all the companies who were involved with us at the time. We hope that they are happy to be mentioned, and we apologise for any omissions or errors. These were: Adelphi, Amiculum, Ashfield Healthcare, Bioscript Group, Circle Science Global, Delta-KN, Chameleon, Havas Lynx, Helios, ipg Health, Nucleus, Prime, Porterhouse, Real Science Communications, Solanum, Spirit, and St Giles Med. Special thanks to the individuals who delivered specific sessions and the companies who supported students on their week placement and project work, to Steven Walker of St Giles Med for advice regarding this paper, and to Peter Llewellyn of Network Pharma for sharing his network with us.

## Disclosures and conflicts of interest

The authors declare no conflicts of interest

## References

1. Wickramasinghe V, Perera L. Graduates', university lecturers', and employers' perceptions towards employability skills. *Educ Train*. 2010 Apr 27.
2. Zimmerman AM. Navigating the path to a biomedical science career. *PloS One*. 2018;13(9):e0203783. doi:10.1371/journal.pone.0203783
3. Mellor F. Twenty years of teaching science communication: A case study of Imperial College's master's programme. *Public Underst Sci*. 2013;22(8):916–26. doi:10.1177/0963662513489386
4. Illingworth S, Redfern J, Millington S, Gray S. What's in a name? Exploring the nomenclature of science communication in the UK. *F1000Research*. 2015;4:409. doi:10.12688/Ff1000research.6858.2
5. Redfern J, Bowater L, Coulthwaite L, Verran J. Raising awareness of antimicrobial resistance among the general public in the UK: The role of public engagement activities. *JAC Antimicrob Resist*. 2020;2(1):dlaa012. doi:10.1093/jacamr/dlaa012
6. Redfern J, Illingworth S, Verran J. What does the UK public want from academic science communication? *F1000Research*. 2016;5:1261. doi:10.12688/f1000research.8815.1
7. Illingworth S, Griffiths D. *SciArt: Teaching across the interface*. EOS: Earth and Space Science News. 2019 Jan 29.
8. Illingworth S, Jack K. Rhyme and reason – using poetry to talk to underserved audiences about environmental change. *Clim Risk Manag*. 2018;19:120–9. doi:10.1016/j.crm.2018.01.001
9. Verran J. Using fiction to engage audiences with infectious disease: The effect of the coronavirus pandemic on participation in the Bad Bugs Bookclub. *FEMS Microbiol Lett*. 2021;368(14):fnab072. doi:10.1093/femsle/fnab072
10. Verran J. Mixed cultures: Encouraging cross-disciplinary collaboration and communication to enhance learning. *Ann Microbiol*. 2019;69:1107-11. doi:10.1007/s13213-019-01481-8
11. Pickering T. What your patient is drawing. *BMJ*. 2019;367. doi:10.1007/s13213-019-01481-8
12. Martínez Silvagnoli L, Shepherd C, Pritchett J, Gardner J. Optimizing readability and format of Plain Language Summaries for medical research articles: Cross-sectional survey study. *J Med Internet Res*. 2022;24(1):e22122 doi:10.2196/22122
13. Gardner J, Silvagnoli LMI, Shepherd C, Pritchett J. Evaluation of plain-language summaries (PLSs): Optimizing readability and format. *Curr Med Res Opin*. 2019; 35:36.
14. Clausi V, Shepherd C, Gardner J, et al. Do corresponding authors value the support of professional medical writers? *Curr Med Res Opin*. 2018;34:33.
15. Leventhal P. Medical writing education. *Med Writ*. 2013;22(1):1
16. Benau D. On educating the medical writer. *Med Writ*. 2013;22(1):26–8.

## Author Information

**Joanna Verran** is Professor of Microbiology (Emeritus) at Manchester Metropolitan University in the Department of Life Sciences and was the instigator and developer of the Medical Writing module.

**Sam Illingworth** is Associate Professor in Academic Practice at Edinburgh Napier University and was the instigator and course leader for the MSc Science Communication at Manchester Metropolitan University.

**James Pritchett** is Senior Lecturer in Biomedical Science in the Department of Life Sciences and was the module leader for Medical Writing.

**James Redfern** is Senior Lecturer in Molecular Microbiology in the Department of Natural Sciences and was a core member of the MSc Science Communication delivery team.

All authors took responsibility for various module leaderships, student mentoring, and project supervision. Joanna Verran conceived the original idea for this manuscript and produced the first draft, with all authors contributing equally to the editing process.