

Creating a Sport and Exercise Medicine Masters syllabus for doctors: a Delphi study

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To cite: Vishnubala D, Iqbal A, Marino KR, et al. Creating a Sport and Exercise Medicine Masters syllabus for doctors: a Delphi study. *BMJ Open Sport & Exercise Medicine* 2022;8:e001252. doi:10.1136/bmjsem-2021-001252

► Additional supplemental material is published online only. To view, please visit the journal online (<http://dx.doi.org/10.1136/bmjsem-2021-001252>).

Accepted 8 January 2022



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ABSTRACT

Objective Sport and Exercise Medicine (SEM) Masters curricula vary. This Delphi study is aimed to create a consensus curriculum for doctors undertaking SEM Masters courses.

Methods A modified Delphi survey was used. An expert panel was established of individuals deemed to have adequate knowledge of the field. The research group developed the initial draft of the curriculum by collating and reviewing previously published UK-based postgraduate SEM-related curricula. There were two phases. In phase 1 the expert group either accepted, rejected or modified each learning objective (LO). During phase 2 the expert group were asked to accept or reject each LO that did not get accepted outright previously. The research group analysed the levels of agreements and the comments given by the expert panel after each phase.

Results The expert panel consisted of 45 individuals, with 35 completing phase 2 (78% retention rate). Of the 136 LOs initially collated: 71 (52%) were accepted outright, 60 (44%) were altered in some way and reincorporated in phase 2, and 5 (4%) were removed after phase 1. The research group added 2 (1%) new LOs on reflection over comments made by the expert panel. The final curriculum contained 133 LOs, divided into 11 subthemes.

Conclusions The findings will better inform educators when developing SEM Masters curricula and inform students what they should look for when considering an SEM Masters. This consensus curriculum is an important step in standardising postgraduate SEM education.

INTRODUCTION

Sports and Exercise Medicine (SEM) became established as a specialty in 2005 in the UK and this has driven increasing demand for education on its core components.¹ SEM postgraduate education varies throughout the world. Some countries offer postgraduate courses in SEM, such as Masters of Science or Postgraduate Diplomas.² Within the UK, there is currently no consensus on what learning objectives (LOs) should be included within both SEM Masters and Diploma courses. Consequently, students undertaking postgraduate SEM qualifications at different

key messages

What are the new findings

- This Delphi study has produced an up-to-date consensus on what skills and knowledge are expected of an individual with a Masters in Sport and Exercise Medicine (SEM) in the UK.
- Practical skills such as ultrasound, joint and soft tissue injections and compartment pressure testing were deemed too specialised to be included in SEM Masters curricula.
- How to develop and deliver exercise medicine services and musculoskeletal services were also deemed inappropriate to include on SEM Masters curricula.

What is already known

- An important aspect in the ongoing evolution of SEM is ensuring adequate SEM skills and knowledge in individuals working as SEM clinicians.
- There is currently no standardisation of SEM Masters courses in the UK.

universities will develop different skills, leading to less standardisation of clinicians employed in SEM posts.

Increased integration of SEM into the National Health Service (NHS) could provide significant benefits.³ An important aspect for the evolution of SEM in the UK is ensuring the development of SEM curriculum for every level of training. Many SEM jobs in the UK require having an SEM Masters in their eligibility criteria. However, there is limited previous research looking into what a Masters course in SEM should include. A study in 2005 in the UK developed LOs for an ideal SEM Masters course, although how the findings influenced or were implemented into curricula is unknown.² This Delphi study aims to develop an up-to-date consensus on what skills and knowledge are expected of an individual with a Masters in SEM in the UK. This will aid in creating a unified and standardised SEM Masters education by universities



throughout the UK. It will also ensure students can appreciate whether their SEM Masters education has provided the necessary skills and objectives to work as a competent SEM clinician.

This study has focused specifically on what LOs doctors undertaking an SEM Masters should hope to achieve. It should be noted that other healthcare professionals also undertake Masters degrees in SEM, and the LOs for these groups are likely to be different due to their role within the multidisciplinary team.

METHODS

Study design

A modified Delphi survey was used to seek consensus on a postgraduate SEM Masters curriculum for doctors. Expert contributions to the study remained anonymous to the research group, in keeping with the principles of Delphi methodology.⁴

Establishing the research group

The research group included the authors DV, KRM, PB, CN, AP and GF. The research group were selected due to their experience in medical education. DV, CN and AP have experience in the exercise medicine sector. DV and CN have experience in delivering SEM education. DV and KRM have undertaken a Masters in SEM. GF and PB have experience in Delphi methodology. DV and KRM have experience in the education of early career SEM professionals through British Association of Sport and Exercise Medicine (BASEM) and roles within UK Universities. Content decisions were finalised by the research group.

Expert Delphi panel

Experts are defined as individuals with knowledge and experience. For this study, they must have adequate knowledge in postgraduate SEM education.^{5,6} Invitations to express interest in being on the expert panel were emailed to all members of the BASEM and the Faculty of Sport and Exercise Medicine (FSEM) via their mailing lists. In addition, members of the research group shared invitations to submit interest in being on the expert panel via social media.

In their expressions of interest individuals were asked demographic information and questions selected by the research panel to determine eligibility. The following eligibility criteria were used:

- ▶ Doctors that have completed their Foundation Training.
- ▶ Hold a higher qualification in SEM: specifically either an SEM Masters degree or diploma. Alternatively, they could have membership or fellowship of the FSEM (MFSEM/FFSEM)
- ▶ Have been a doctor for more than 5 years
- ▶ Working in the UK at the time of the study.

The research group reviewed the responses and removed those that did not match the eligibility criteria. Regarding the size of the expert panel, a panel size of

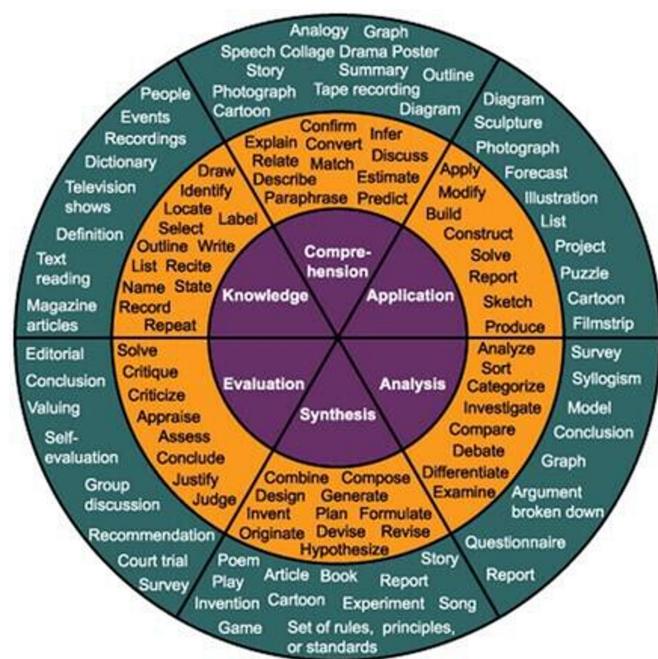


Figure 1 Bloom's taxonomy wheel. Level 1 is knowledge, level 6 is evaluation. Image used within rules of license (creative commons attribution—sharealike license). Taken from: <https://www.wyl.io/credits/flickr/4100721032#>.

more than 30 is not considered to improve the quality of the study.^{4,7}

Development of the initial curriculum

The research group developed the initial curriculum draft by collating and combining previously published LOs from UK-based SEM specialty training curriculums and a previous paper exploring the LOs required for an ideal SEM Masters curriculum published in 2006.^{2,8,9} This approach was used to ensure no potential relevant LOs were omitted. The LOs taken from the pre-existing curricula were grouped into suitable themes by the research group using themes previously published. All LOs were reviewed by the research group and edited, if needed, using Bloom's taxonomy wheel (figure 1) to make them suitable for postgraduate level.¹⁰

Procedure

The initial survey to express interest in joining the expert panel was made using Google Forms (Google). Demographic information was obtained through this form. For the Delphi itself, electronic surveys were created using Qualtrics software and a link to it was emailed to all eligible members of the expert panel.¹¹ The participant information sheet was attached to the email, along with contact details of the research group. Consent was gained via a mandatory question given before starting the Delphi. The instructions clearly stated that experts should consider the curriculum to be relevant for doctors undertaking a Masters in SEM, not considering other professions that may also undertake a Masters in SEM.

Engagement from the expert panel is crucial for any Delphi study and the aim was for the response rate to not fall below 70%.¹² Experts were given 12 days to complete each phase of the Delphi. Non-responders after 8 and 10 days received a system-generated reminder. Text reminders were also sent to the expert panel if no response had been received on day 11. Only experts that completed phase 1 of the Delphi were invited to participate in phase 2. The data were collected between October and November 2020.

Phase 1: review of the draft curriculum

During phase 1, panel members reviewed the curriculum and were asked to accept, reject or modify each item. Participants were given the option of providing an anonymous comment after each decision. The percentages of agreement for each LO were calculated and, along with all comments, were read through and discussed by the research group. The response to each LO was discussed regardless of the level of agreement from the expert panel. After the collected data were reviewed, the research group agreed to either accept, reject or alter each LO to create a second version of the proposed curriculum. LOs with levels of agreement above 75% with no comments were accepted. The research group reviewed all comments on LOs that had been accepted and the LOs were amended accordingly and included in phase 2. LOs with levels of agreement below 75% without comments were rejected. For those with comments, these were reviewed by the research group, and where it was felt appropriate a modified LO was added for further review in phase 2.

Phase 2: second review of proposed curriculum (accept or reject)
A link to the second version of the curriculum was sent to all expert panel members that completed phase 1. For this phase, they were only provided with the option to accept or reject each LO. As reported by Keeney *et al*, a consensus was defined by 75% agreement.¹³ Previous literature reports varied levels appropriate for consensus, ranging from 70% to 100%.⁶ There was an optional open comments box at the end of each theme for further comments. The LOs accepted outright after phase 1 and did not require further input were included for reference. Again, the percentage of agreement was calculated, the research group reviewed all comments and a consensus was reached to either accept or reject each LO. Phase 2 would be repeated until a final consensus on the syllabus was reached.

RESULTS

The initial proposed curriculum

There were 136 LOs collated from prior SEM syllabi. The research group divided these across 11 distinct themes.

The expert panel

Of the 94 people interested in being on the expert panel, 48% (45/94) met the eligibility criteria. The reasons for non-eligibility included having worked as a doctor for less than 5 years (n=19), not holding an SEM Masters/Diploma/FFSEM/MFSEM (n=17) and not being based in the UK

Table 1 The reasons for alterations to LOs after phase 1

Reasons for alteration	Number of learning objectives (LOs) altered
Spelling and grammar (including re-wording)	44 (32%)
Alteration to Bloom taxonomy level	34 (25%)
Objective made more specific	10 (7%)
Objective made more broad	2 (1%)

The percentage of LOs altered for each reason is also provided.

(n=13). The expert panel consisted of 20 SEM consultants, 4 orthopaedic consultants, 1 rheumatology consultant, 17 general practitioners, 11 SEM registrars and 14 doctors that did not specify their training or job role but did confirm that they had been a doctor for more than 5 years. All the 14 doctors that did not specify their training/job role had completed a SEM MSc or Diploma and 57% had been a doctor for 13 years or more. Twenty-one individuals on the expert panel (47%) had experience teaching SEM Masters and Diploma courses.

Phase 1

In phase 1 of the study there was a 100% (45/45) response rate from the expert panel. Fifty-two per cent (71/136) of the LOs were accepted without the need for alteration, and 44% (60/136) were altered. The reasons for alterations are given in table 1. Thirty LOs were altered for more than one reason. Regarding the alterations made to the Bloom taxonomy level, 44% (n=15) were moved to a higher taxonomy level, 41% (n=14) were moved to a lower taxonomy level and for the final 15% (n=5) the wording was altered but the LO was kept within the same taxonomy level.

Five LOs (4%) were rejected and all were removed due to being deemed too high level for postgraduate SEM Masters. The objectives removed for being too high level are given in table 2, alongside comments given by the expert panel that contributed to the research group deciding on their removal. The first two LOs listed in table 2 regarding developing, leading and delivering exercise medicine services and MSK services received an agreement of 78% and 80%, respectively. Despite being above the approval threshold, the research group discussed these objectives at length, taking on board comments given by the expert panel, and determined these LOs were too high a level for a Masters level.

On reviewing the comments given by the expert panel, the research team added the following two LOs to the proposed curriculum:

1. Discuss a range of common ethical issues in a team sport environment (added to 'sports team and event management' subtheme)
2. Recognise the key medico-legal requirements and considerations in team medicine (added to 'sports team and event management' subtheme).



Table 2 The LOs removed after phase 1 and comments given by the expert panel which contributed to justifying the removal of the LO

Learning objective (LO) removed	Expert panel quotes supporting the removal
1. Develop, lead and deliver both paediatric and adult exercise medicine services	<i>Be able to contribute to the delivery of - Reduce the taxonomy order (Participant 41)</i>
2. Develop, lead and deliver both paediatric and adult musculoskeletal services	<i>Demonstrate awareness of - Not all MSc courses offer the chance for delivery (Participant 39)</i>
3. Perform a targeted ultrasound examination of a peripheral musculoskeletal problem	<i>Does not need to be part of SEM MSc - needs to be a separate course (participant 21)</i> <i>Reject as this is an additional skill that isn't going to be taught as part of MSc (participant 30)</i>
4. Inject a variety of joints and soft tissues with radiological guidance	<i>Does not need to be part of SEM MSc - needs to be a separate course (participant 21)</i> <i>I don't feel this is mandatory for MSc level (participant 42)</i>
5. Perform compartment pressure testing	<i>Not sure this is an essential component- would be done in Secondary Care (participant 33)</i> <i>Reject as advanced skill? beyond this level - know how it is done (participant 28)</i>

SEM, Sport and Exercise Medicine.

These were both added due to comments made by members of the expert panel at the end of the survey when asked if they had any final thoughts. The first was added due to a participant stating: 'I would also add a section on Ethics and how this may impact the SEM physician' (participant 31). The second was added due to a member of the expert panel stating: 'Medico-legal issues in sports' (participant 18). On discussing these within the research group the value of both comments were noted, and it was therefore deemed important to add related LOs.

Phase 2

Of the 45 that completed phase 1, 78% (35/45) of these individuals also completed phase 2. All LOs (100%) were accepted in phase 2 of the study, with all objectives achieving over 85% agreement. No alterations were made to any LOs. Therefore, no further phases were required. The final curriculum consisted of 11 subthemes (outlined in table 3) and 133 LOs. The full version of the final curriculum can be found in the online supplemental information.

DISCUSSION

Summary of findings

An expert panel of 45 (100% of those eligible) completed phase 1 of this modified Delphi study, with 35 also completing phase 2 (78% retention rate). One hundred and thirty-six LOs were reviewed, with five removed during phase 1 after being deemed too high level for an SEM Masters degree. Two additional LOs were added, resulting in a final curriculum of 133 LOs, all of which were accepted by the expert panel during phase 2.

The importance of a standardised SEM Masters curriculum for doctors

Obtaining a high-quality and relevant education in SEM should be a critical goal for all physicians working in SEM.¹⁴ Although there is no specific data on this, anecdotally, the research group is aware that a large proportion of doctors working in the field of Sport and Exercise Medicine are not SEM consultants or on SEM specialty training programmes. For this group, their SEM knowledge and experience will be heavily influenced through the completion of an SEM Masters. It is reasonable to assume physicians will want their SEM Masters to be as relevant as possible to being an SEM physician, particularly given the cost and time-commitment of undertaking a Masters degree.

Table 3 The finalised subthemes and number of learning objectives within each subtheme

Subtheme	Number of objectives in subtheme
1. Physical activity and human health	13
2. Medical issues related to exercise	16
3. Injuries related to SEM	22
4. Basic science in SEM	18
5. Clinical pharmacology	6
6. Antidoping	4
7. Sports team and event management	28
8. Physical activity in challenging environments	1
9. Specific groups in SEM	11
10. Intrinsic skills of an SEM clinician	3
11. Extrinsic skills of an SEM clinician	11
Total	133

As a relatively new specialty SEM is continuing to find its place within the UK healthcare system; many fellow healthcare professionals have limited knowledge of the specialty and the skills SEM physicians possess.^{15 16} As a specialty we need to demonstrate we can stand alongside conventional specialties by being prepared to methodically examine our practice, ensure physicians practising within SEM are sufficiently capable and ensure they are working at a high level consistent throughout the UK.¹⁷ It is becoming increasingly common for SEM posts to include having an SEM Masters in their desirable or essential job criteria. The need to standardise SEM Masters curricula is therefore becoming increasingly important. It will be beneficial to the professionalism of the specialty to ensure individuals working in SEM posts that require an SEM Masters possess similar, consistent skills and knowledge.

Aspects too specialist for SEM Masters level

The expert panel rejected the practical LOs around performing ultrasound, joint and soft tissue injections and compartment pressure testing, with comments implying that they are too high level for SEM Masters courses. Ultrasound imaging is increasingly used in SEM to diagnose and monitor injuries; diagnostic ultrasound has previously been described as the 'sports physicians stethoscope'.¹⁸ A 2017 International Consensus statement outlining a generic syllabus for SEM specialty training includes an 'advanced skill' of 'targeted ultrasound examination of a peripheral musculoskeletal problem'.⁹ How best to provide ultrasound training to SEM clinicians, or a consensus decision as to whether it is needed, remains a controversial issue.¹⁸ The research group anecdotally acknowledges that many SEM clinicians choose to self-fund ultrasound training courses and equipment. The findings of this study indicate that ultrasound training should not be included in SEM Masters' teaching.

LOs focused on developing and delivering exercise medicine services and musculoskeletal services were also not deemed appropriate to include in this curriculum, with several expert panel members commenting on issues with SEM Masters including these LOs. The research group discussed these objectives at length and deemed that these objectives would be more suitable for SEM consultant level or specialist SEM trainees. FSEM have created resources to aid SEM doctors in setting up SEM clinics and services, such as 'Sport and Exercise Medicine: A Fresh Approach in Practice' published in 2014.¹⁹ Interestingly, the 2017 International Consensus syllabus for SEM specialist training does not include learning how to set up an SEM service, nor does the most recent UK SEM specialist training programme curriculum.^{8 9} With increasing interest in how SEM can best be integrated into the NHS given the benefits SEM services can provide, it would be of great interest for further research be done to determine how the SEM specialty can most effectively³ increase the number of SEM services offered in the UK.

Catering to all SEM Masters students

Doctors at any stage in training can undertake a Masters in SEM, and doctors at different stages in training may require different outcomes from a Masters course. It is also important to acknowledge that other healthcare professionals undertake an SEM Masters degree, such as physiotherapists, osteopaths and sports therapists. While there will be overlap, the outcomes these professionals wish to achieve from an SEM Masters are likely to be different to the LOs for doctors. Future research may consider exploring an appropriate SEM Masters curriculum for other healthcare professionals; it would be interesting to compare and contrast these with this curriculum.

Strengths

A modified Delphi was conducted thoroughly, following the appropriate methodology.⁴ The expert panel consisted of highly qualified individuals from relevant professional backgrounds. A high level of engagement and response rate was achieved. Many, often detailed, comments were received from expert panel members to justify responses. The research group contains individuals with a wide range in level of training. A high level of acceptance was achieved for each of the LOs included in the final curriculum. As no repeats to phase 1 or phase 2 were required, there were only two rounds of the Delphi before the finalised curriculum being created. Less than three rounds are recommended to reduce participation fatigue.^{13 20 21}

Limitations

Although demographic data was removed, due to the nature of the questions asked to deem eligibility criteria, the research group may have been able to deduce who expert panel members were, resulting in bias. In addition, despite Masters degrees being primarily academic degrees, the only mention of research in the final proposed curriculum is in one LO listing research as a skill commonly used in practice by SEM physicians that the learner should be able to demonstrate. This is likely due to vocational-based curriculums being used to create the initial proposed list of LOs developed by the research group. It may be appropriate for educators creating curricula for SEM Masters to consider including additional research-related LOs. Given the nature of a Delphi study, the study is limited by the research group members and expert panel. The study methodology is by design opinion-based and open to researcher and participant bias. In addition, it would have been beneficial to know the specific training/job role of the 14 doctors on the expert panel that did not provide this information. However, all of these doctors had an MSc or Diploma in SEM and had all been a doctor for 5 years or more, with the majority having been a doctor for over 10 years.



CONCLUSION

The findings of this study will better inform educators involved in developing SEM Masters curricula, and inform students as to what they should look for when considering undertaking a Masters in SEM. This consensus curriculum is an important step in the standardisation of postgraduate SEM education. The next step will be to ascertain views of the finalised consensus curriculum from individuals involved in delivering, teaching and examining SEM masters content in the UK.

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Contributors DV conceived the idea of creating a piece of work on this topic. DV, AI and KRM were involved in data collection. DV, KRM, PB, CN, AP and GF sat on the research group and analysed the data. All authors contributed to the critical revision and approval of the final editorial. DV is the guarantor of this study.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not applicable.

Ethics approval Ethics approval was granted by Hull York Medical School.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement No data are available. Not applicable.

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Syllabus for doctors on Postgraduate SEM Masters courses

1. Physical Activity and Human Health	
	Demonstrate an understanding of the role of physical activity in the prevention and treatment of common long-term health conditions
	Advise on and promote population health through physical activity
	Make use of physical activity guidelines and recommendations in practice
	Analyse current UK screening programmes to promote health
	Analyse key national and international physical activity resources available to patients and clinicians
	Discuss how to overcome the following barriers to physical activity: environmental, social, physical, cultural, religious and psychological
	Demonstrate the ability to prescribe physical activity in healthy individuals and also individuals with disease
	Critically apply physical activity guidelines in both the prevention and management of chronic disease
	Design a physical activity programme for a variety of special populations (e.g. older adults, pregnancy, disability, children)
	Analyse and overcome factors that may impact physical activity prescribing
	Recognise the importance of communicating the physical activity message beyond the individual
	Demonstrate an understanding of public health policy development and implementation in relation to physical activity and health
	Understand and promote integrated sport and physical activity opportunities for school aged children and adolescents in order to promote a lifelong relationship with physical activity
2. Medical Issues Related to Exercise	
	Discuss aspects of the following including aetiology, epidemiology, clinical features, investigation, management and prognosis in relation to physical activity:
	Neurological conditions
	Discuss aspects of the following including aetiology, epidemiology, clinical features, investigation, management and prognosis in relation to physical activity:
	Respiratory conditions including: Asthma - Chronic Obstructive Pulmonary Disease - Exercise Induced Laryngeal Obstruction - Exercise Induced Bronchospasm
	Discuss aspects of the following including aetiology, epidemiology, clinical features, investigation, management and prognosis in relation to physical activity:
	Common infectious diseases
	Discuss aspects of the following including aetiology, epidemiology, clinical features, investigation, management and prognosis in relation to physical activity:
	Cardiovascular conditions including: HOCM and other cardiomyopathies – Structural abnormalities – Arrhythmias – Valvular disease – Hypercholesterolaemia – Hypertension – Ischaemic heart disease - Heart failure - Inherited channelopathies - Congenital disease
	Discuss aspects of the following including aetiology, epidemiology, clinical features, investigation, management and prognosis in relation to physical activity:
	Common gastrointestinal conditions

Syllabus for doctors on Postgraduate SEM Masters courses

	<p>Discuss aspects of the following including aetiology, epidemiology, clinical features, investigation, management and prognosis in relation to physical activity:</p> <p>Common renal and urogenital conditions</p> <p>Discuss aspects of the following including aetiology, epidemiology, clinical features, investigation, management and prognosis in relation to physical activity:</p> <p>Metabolic conditions including: Diabetes – Thyroid disease – Obesity</p> <p>Discuss aspects of the following including aetiology, epidemiology, clinical features, investigation, management and prognosis in relation to physical activity:</p> <p>Common ENT conditions</p>
	<p>Discuss aspects of the following including aetiology, epidemiology, clinical features, investigation, management and prognosis in relation to physical activity:</p> <p>Common immunological conditions</p>
	<p>Discuss aspects of the following including aetiology, epidemiology, clinical features, investigation, management and prognosis in relation to physical activity:</p> <p>Common haematological conditions</p>
	<p>Discuss aspects of the following including aetiology, epidemiology, clinical features, investigation, management and prognosis in relation to physical activity:</p> <p>Common dermatological conditions</p>
	<p>Discuss aspects of the following including aetiology, epidemiology, clinical features, investigation, management and prognosis in relation to physical activity:</p> <p>Rheumatological conditions including: Inflammatory and seronegative arthritis, Osteoarthritis, Fibromyalgia and chronic pain, Connective tissue disorders, Hypermobility syndromes, Osteoporosis</p>
	<p>Discuss aspects of the following including aetiology, epidemiology, clinical features, investigation, management and prognosis in relation to physical activity:</p> <p>Psychological and mental health conditions including: Eating and body perception disorders in the developing athlete - Anxiety - Depression – Stress - Trauma</p>
	<p>Discuss aspects of the following including aetiology, epidemiology, clinical features, investigation, management and prognosis in relation to physical activity:</p> <p>Adult musculoskeletal conditions including: Acute pain - Acute musculoskeletal conditions - Chronic pain - Chronic musculoskeletal conditions</p>
	<p>Discuss aspects of the following including aetiology, epidemiology, clinical features, investigation, management and prognosis in relation to physical activity:</p> <p>Paediatric musculoskeletal conditions including: Fractures - Ligamentous injuries and complications - Apophyseal injuries -</p>

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	<p>Overuse injuries - Growth plate stress - Osteochondritis dissecans - Snapping hip - Shoulder instability - Patella instability - SUFE - Perthes - Scoliosis - Talipes - Flexible pes planus - Chest wall deformities - Timings of growth plate closure</p> <p>Demonstrate the ability to deliver age appropriate injury rehabilitation programmes illustrating understanding of the biomechanical principles underpinning the individuals' chosen activity</p>
3. Injuries Related to SEM	<p>Apply the principles of prevention, diagnosis, and treatment of injuries related to sports and physical activity</p> <p>Analyse management plans for optimal treatment of patients across the spectrum of musculoskeletal problems in accordance with latest guidelines and best practice, and involving other allied health professionals where appropriate</p> <p>Apply knowledge of the pathophysiology of tissue injury and subsequent clinical symptoms and presentations of musculoskeletal disease to the management and rehabilitations of a range of common presentations</p> <p>Analyse the evidence-based management of common head and neck injuries</p> <p>Analyse the evidence-based management of common upper limb injuries</p> <p>Analyse the evidence-based management of common trunk, abdominal and thoracic spinal injuries</p> <p>Analyse the evidence-based management of common lumbar spine and pelvic injuries</p> <p>Analyse the evidence-based management of common lower limb injuries including:</p> <p>Tendinopathies - Ligament injuries - Avulsion injuries - Dislocation - Fracture management Other common soft tissue injuries</p> <p>Recognise red flags which may indicate malignancy or infection</p> <p>Interpret the findings of radiological and other relevant investigations to determine differential diagnoses</p> <p>Apply the principles of biomechanics to different sporting and physical activities and in the context of injury</p> <p>Recognise the role of physical activity in rehabilitation</p> <p>Devise a rehabilitation programme in relation to common sports injuries</p> <p>Analyse the role of surgery in the management of common sports injuries</p> <p>Analyse rehabilitation progression and return to activity factors when managing common musculoskeletal conditions</p> <p>Be able to interpret human movement analysis - basic kinematics and kinetics</p> <p>Explain the role of biomechanical analysis of sport specific techniques in the management of sports related injuries</p> <p>Analyse the effects of variations in biomechanics and the influence of posture on common musculoskeletal presentations</p> <p>Analyse the role of orthotics in the management of common sports injuries</p> <p>Recognise the role of splinting, bracing and taping techniques</p> <p>Apply an understanding of level 3 safeguarding knowledge to a range of hypothetical or retrospective cases</p> <p>Discuss the relevance of common radiological investigations including the suitability of each modality for a range of contexts</p>
4. Basic Science in SEM	<p>Analyse the principles of exercise physiology including: types of physical activity, effects of physical activity and maximising adaptations to sport and physical activity</p>

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	Discuss the principles of body morphology in the context of sport and physical activity
	Apply the key principles of sports psychology to sport and physical activity
	Analyse the impact of common diseases and medications on normal exercise physiology
	Describe clinically relevant regional anatomy including normal variations
	Describe the anatomy of joints and musculo-tendinous units
	Describe the characteristics of bone, tendon, ligament, articular cartilage and muscle
	Apply anatomical knowledge to history taking, physical examination and imaging
	Describe cellular metabolism and biomechanical pathways of energy production
	Apply the principles of strength and conditioning to formulate a basic plan
	Undertake appropriate assessments of fitness
	Discuss energy release from various sources including fats, carbohydrates, proteins
	Discuss physiological responses and adaptations to exercise
	Discuss the role of genetics in sport and physical activity
	Discuss the role of macro and micronutrients
	Discuss the key principles of hydration in sport and physical activity
	Discuss the benefits and risks of nutritional supplements in sport and physical activity
	Discuss the effects of alcohol on performance
5. Clinical Pharmacology	
	Discuss the issues of medication abuse in elite athletes
	Discuss the influence of medications used in the treatment of disease on physical activity capacity
	Discuss medication and exercise interactions which may cause or worsen disease
	Prescribe safely by considering, contraindications, side effects, drug interactions and dosage of commonly used drugs in sport and physical activity
	Discuss the regulations regarding travelling with medicines
	Discuss the governance of medicine storage and management systems
6. Antidoping	
	Apply knowledge of the WADA prohibited list in both practice and hypothetical scenarios
	Understand the WADA therapeutic use exemption process
	Detail the consequences of doping: health risks, sanctions and responsibilities
	Recognise suitable resources and tools to support athletes and clinicians regarding medications and anti-doping
7. Sports Team and Event Management	
	Describe the roles of the SEM physician in the team environment
	Describe the features of good team dynamics
	Describe the role of the main organisations of sport, sports medicine and health promotion at a national and international level
	Discuss the relevant medical codes on the ethical treatment of athletes (e.g. Olympic code, FSEM code)
	Analyse the components and processes of pre-participation screening for athletes and event participants
	Discuss the key components of preseason and pre event medical organisation
	Analyse the recognition and management of disordered eating and RED-S

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	Discuss the equipment, medical supplies and facilities required for team and event care
	Perform risk assessments of training and competition venues
	Discuss common match and event day medical issues
	Demonstrate the on-field assessment and management of sports injuries and medical conditions
	Discuss the psychological aspects of motivation, arousal and performance
	Discuss a range of common ethical issues in a team sport environment
	Recognise the key medicolegal requirements and considerations in team medicine
	Discuss aspects including aetiology, epidemiology, clinical features, investigation, management and prognosis of the following in relation to sport and physical activity:
	Cardiorespiratory arrest
	Discuss aspects including aetiology, epidemiology, clinical features, investigation, management and prognosis of the following in relation to sport and physical activity:
	Sudden death in sport, both cardiac and traumatic causes
	Discuss aspects including aetiology, epidemiology, clinical features, investigation, management and prognosis of the following in relation to sport and physical activity:
	Concussion and head injury
	Discuss aspects including aetiology, epidemiology, clinical features, investigation, management and prognosis of the following in relation to sport and physical activity:
	Acute musculoskeletal and soft tissue injuries
	Discuss aspects including aetiology, epidemiology, clinical features, investigation, management and prognosis of the following in relation to sport and physical activity:
	Basic management of fracture and dislocations
	Discuss aspects including aetiology, epidemiology, clinical features, investigation, management and prognosis of the following in relation to sport and physical activity:
	The acutely unwell patient
	Discuss aspects including aetiology, epidemiology, clinical features, investigation, management and prognosis of the following in relation to sport and physical activity:
	Eye and ENT emergencies
	Apply the principles of pre-hospital care to a range of common sport and physical activity emergencies
	Demonstrate simple skin closure and suturing and have an awareness of the indications for each
	Demonstrate basic airway management and deliver effective resuscitation
	Demonstrate defibrillation and cardiorespiratory resuscitation
	Advise on screening programmes to detect those at risk of sudden death in sport

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	<p>Discuss the findings of any abnormalities raised during screening with athletes, family members and carers</p> <p>Demonstrate prompt assessment of the acutely deteriorating patient, including those who are shocked or unconscious, and deliver appropriate, evidence-based care</p>
8. Physical Activity in Challenging Environments	<p>Be able to manage common issues in SEM relating to physical activity in extreme environments including: cold environments, hot environments and altitude (</p>
9. Specific Groups in SEM	<p>Be able to manage issues in SEM relating to specific groups of athletes in sport including: paediatric, female, ageing, adventure sports and athletes with a disability</p> <p>Apply the effects of the ageing process when providing physical activity advice</p> <p>Apply knowledge of the physiological changes during and after pregnancy when providing physical activity advice to pregnant and post-partum individuals</p> <p>Demonstrate the ability to advise women on undertaking safe exercise throughout the lifespan including advising on energy balance, bone health and hormonal influences</p> <p>Discuss the management of common issues affecting disabled athletes and exercisers in relation to sports and physical activity</p> <p>Discuss physical problems experienced by amputees and wheelchair users with everyday living and with respect to sport</p> <p>Discuss contraception options in athletes</p> <p>Demonstrates an awareness of the unique needs of patients with disabilities, the barriers faced in participating in physical exercise and the ability to advise those with disabilities how to undertake safe exercise</p> <p>Understanding the social, psychological religious and cultural factors that influence physical activity participation and demonstrate initiatives to overcome these</p> <p>Demonstrates knowledge of the anatomical, physiological, psychosocial, sexual and educational development of children and adolescents in the management of musculoskeletal conditions</p> <p>Demonstrates knowledge of the aspects that enhance care during the transition and transfer between paediatric and adult services across healthcare</p>
10. Intrinsic Skills of a SEM Clinician	<p>Demonstrate the following skills commonly used in practice by SEM physicians:</p> <p>Communication - Collaboration - Leadership and management - Health advocacy - Safety - Research - Teaching - Learning - Professionalism -Consideration of ethics, cultural religious and LGBTQ awareness</p> <p>Demonstrate the ability to work within a multidisciplinary team</p> <p>Demonstrate the need to coordinate care across multiple agencies to address physical, psychological and social needs in community, secondary care, recreational and elite sporting environments</p>
11. Extrinsic Skills of a SEM Clinician	<p>Perform a comprehensive examination of the musculoskeletal and neurological systems and interpret the findings sufficiently to develop a clinically reasoned diagnosis and management plan</p> <p>Perform a sport-specific medical and musculoskeletal screening examination</p>

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	Provide safe and effective immediate medical care for on-field injuries and medical events
	Perform concussion screening examinations, baseline and postinjury, and interpret the results
	Recognise the indications of a range of radiological and other investigations relating to sport and physical activity
	Analyse ECG findings in an athlete and recognise the indications for onward referral
	Discuss the indications, benefits and risks of a variety of common joint and soft tissue injections
	Have an understanding of the role of a range of commonly used protective braces
	Recognise the indications for taping joints, tendons and muscles and its role in injury prevention and treatment
	Interpret simple video analysis of a variety of sporting skills including running gait
	Analyse the indications for and findings of resting and exercise lung function tests