Advanced musculoskeletal physiotherapy practice: Informing education curricula

Orna Fennelly a, *, François Desmeules b, Cliona O’Sullivan a, Nicola R Heneghan c, Caitriona Cunningham a

a School of Public Health, Physiotherapy and Sports Science, University College Dublin, Belfield, Dublin, Ireland
b School of Rehabilitation, University of Montreal, Canada
c School of Sport, Exercise and Rehabilitation Sciences, University of Birmingham, United Kingdom

ARTICLE INFO

Keywords:
Physical therapy specialty
Education
Musculoskeletal diseases
Clinical competence
Competency-based education
Advanced practice

ABSTRACT

Introduction: Physiotherapists are operating at an advanced level of practice, usually on ad hoc basis with inhouse training, in response to the increasing burden of musculoskeletal (MSK) disorders. Discrepancies in role-specific education of advanced practice physiotherapists (APPs) creates challenges in ensuring a quality service, workforce mobility and formal recognition. This study reviewed existing MSK APP competency frameworks and education offerings, and explored physiotherapist learning needs with a view to informing international standardisation of MSK APP education curricula.

Methods: A scoping review of the literature and relevant university and regulatory websites identified APP competency frameworks and education curricula, which were verified by international experts. Content analysis, performed on the identified competencies and modules, produced a list of themes existing in MSK advanced practice internationally. A survey based on those themes identified the learning priorities of physiotherapists (n = 25) participating in an APP symposium in Ireland.

Results: Six APP competency frameworks and eleven curricula from the UK, Canada and Australia were identified. Themes emerging, regarding MSK APP practice internationally, included both entry-level physiotherapy (e.g., Assessment and Diagnosis) and traditionally medically-controlled tasks (e.g., Injection Therapy), as well as Advanced practice roles more commonly prioritised competencies which would be deemed beyond entry level physiotherapy skills (i.e., Radiology versus Manual Therapy).

Conclusion: Despite variances in profiles of APPs both between and within countries, common themes emerged regarding their expected competencies and skills. This study provides the foundation for the adoption of internationally-recognised MSK APP competencies and education standards.

1. Introduction

The impact of musculoskeletal (MSK) disorders includes poor health related quality of life, increased healthcare utilisation (van der Zee-Neuen et al., 2016), sickness absence from work and loss of productivity (Bevan et al., 2009; EUMUSC.net, 2007). Physiotherapy roles and education pathways are evolving to ensure that physiotherapists have the right mix of skills and competencies in order to respond to the growing MSK burden and address patient needs (WHO, 2013; World Confederation of Physical Therapists, 2019; King et al., 2017). These enhanced roles often require physiotherapists to operate at an advanced level of practice rather than in a specific role (McNeill and Poole, 2014; Chartered Society of Physiotherapists, 2016), and perform traditionally medically-controlled tasks e.g., triaging patient care, prescribing medications, ordering imaging and administering injections (McPherson et al., 2006). Advanced practice physiotherapists (APPs) often manage the care of patients who are deemed not to require medical or surgical interventions (Fennelly et al., 2018a; Wood et al., 2016), with the aim of reducing wait times and providing more appropriate care for these patients (Fennelly et al., 2018a; Razmjou et al., 2013; Daker-White et al., 2016).
Advanced practice physiotherapy services have emerged in countries including the United Kingdom (UK), Australia, Canada and Ireland (Fennelly et al., 2017), and commonly within MSK services across orthopaedics, rheumatology, emergency departments and primary care (Fennelly et al., 2017; Desmeules et al., 2012), but also in neurology, cardiorespiratory and women’s health services (Lockstone et al., 2019; Brismee et al., 2018; Saxon et al., 2014; Brennen et al., 2019). These APP services have usually been developed on an ad hoc basis, allowing them to be adapted to the specific needs of the local service with provision of inhouse training (Welsh Government, 2011; Stevenson et al., 2020). This was the case in Ireland where initially clinical specialist physiotherapists began working at an advanced practice level in low back pain and fracture clinics at individual hospitals (Curley et al., 2004; Moloney et al., 2009). Since 2011, a national MSK Physiotherapy Triage Initiative has established 24 APP positions across orthopaedic and rheumatology services in 18 acute hospitals (Fennelly et al., 2018a). However, lack of national credentialing, clearly defined scope of practice of APPs and standardised training, both in Ireland and internationally, presents service challenges and professional issues (Skinner et al., 2015). These include inconsistent job titles and descriptions (Froment et al., 2019), blurring of professional boundaries (Tawiah et al., 2018; Labey and Currie, 2005), lack of professional recognition, remuneration and governance (Distler, 2007; Broome, 2015), and difficulty demonstrating the transferability of skills and generalisation of the overall benefits of such models of care (Welsh Government, 2011; Holdsworth et al., 2008; Moffatt et al., 2017; O Sullivan and Doody, 2014). Additionally, inhouse training alone can lack the rigour and resources required to ensure standardised certification (Skinner et al., 2015).

A masters or doctorate level of education and more than five years of specific MSK experience is required by APPs in the UK and Australia (Chartered Society of Physiotherapists, 2016; Australian Physiotherapy Association (APA), 2009), and most APPs in Ireland also meet these criteria (Fennelly et al., 2018b). However, discrepancies exist between the post-graduate education and continuous professional development (CPD) on offer and completed (Stanhope et al., 2012). This leads to variability in practice and potential gaps in knowledge (Fennelly et al., 2018b), which could potentially affect patient outcomes (Skinner et al., 2015). The World Confederation of Physical Therapy (WCPT) (World Confederation of Physical Therapists, 2019) and APPs themselves (Fennelly et al., 2018b; Morris et al., 2014; Dawson and Ghazi, 2004) have therefore advocated for a clear definition of APP professional competencies and standardised education. Additionally, an apprenticeship model for advanced practitioners to help standardise education is currently under development in the UK (Chartered Society of Physiotherapists, 2017). Adoption of standardised MSK APP competencies internationally would promote consistent use and recognition of the advanced practice title, and enable physiotherapists to demonstrate capability to competently and safely undertake tasks at an advanced practice level (Labey and Currie, 2005; Crane and Delany, 2013).

To design competency-based education, which is increasingly being used in the education of advanced practitioners (Skinner et al., 2015; Broome, 2015; Bergstrom and Lindh, 2018), Parson et al. (2018) recommended the following steps: (1) identification of the required APP competencies, (2) organisation of competencies into themes, (3) organisation of themes into courses, and (4) organisation of courses into curricula. Stakeholder input is also needed to review the clinical priorities, learner needs of the service, and the overall health system within which the service is to be situated (Harding et al., 2015; Lee et al., 2013). As APPs have existed in MSK services for over 30 years (Byles and RSM, 1989), a variety of competency frameworks and education curricula have likely been adopted internationally. Therefore, this study aimed to review the existing international APP competency frameworks and education curricula, and explore physiotherapist learning needs in a local context, with a view to informing the development and enhancement of MSK APP education curricula.

2. Methods

2.1. Study design

A scoping review was performed based on the framework proposed by Arksey and O’Malley (2005) (Arksey and O’Malley, 2005), with reporting guided by the PRISMA-SCR checklist (Tricco et al., 2018). These data were triangulated with a cross-sectional survey of physiotherapists in Ireland.

2.2. Ethics

The Human Research Ethics Committee at University College Dublin approved conduct of this study.

2.3. Data collection

To identify existing competency frameworks, education programmes and learning priorities for physiotherapists, data were collected and triangulated from several sources (Fig. 1). This method was based on previous research which aimed to identify education needs for health professionals (Gardner et al., 2006; Niles and Hunt, 2018).

2.3.1. Identification of APP competencies and curricula

A search of PubMed and the Cumulative Index to Nursing and Allied Health Literature (CINAHL) databases was conducted using key words and subject headings related to “Physiotherapy”, “Advanced Practice” and “Education” or “Competency” [Appendix], initially in 2018 and repeated in January 2020. The identified articles (n = 180) were screened by title and abstract, with the full text articles of potentially relevant papers accessed to identify whether an APP competency framework or education curriculum, which met the established inclusion criteria (Table 1), was reported. Reference lists of the relevant articles (n = 8) were also searched for any additional studies and to identify the source of the education curricula or competency framework. As the researchers recognised that not all APP competency frameworks and education curricula were cited within the identified articles, hand-searching was conducted of all professional regulatory body websites and websites of universities from countries with well-established APP roles (i.e., UK, Canada, Australia). This scoping review also included consultation with leaders in MSK physiotherapy education from those countries to ensure inclusion of all known advanced practice specific frameworks and education curricula, and to gain valuable insights (Arksey and O’Malley, 2005).

2.3.2. Survey of physiotherapists in Ireland

Based on the review of APP competency frameworks and education curricula, as well as the experiences of MSK physiotherapy education providers, a survey instrument was designed. This survey provided a list of potential curriculum topics and asked respondents to prioritise these, as utilised in previous healthcare research (Ardoin et al., 2019). This initial survey was reviewed for comprehensiveness by APPs and the final survey included 29 learning topics under each of the themes emerging from the identified MSK APP competencies and education curricula, with opportunity given to the physiotherapists to recommend further learning priorities. The survey was then distributed at an advanced practice research and education symposium hosted at University College Dublin, Ireland, in August 2018, which included presentations from researchers in the field of advanced practice from Ireland and Canada, and an open audience discussion. This was attended by physiotherapists, physiotherapy managers, health and social care professional representatives, rheumatology consultant doctors and physiotherapists in academic roles in Ireland.
2.4. Data charting

Standardised proformas on Excel (Microsoft Office 365) were used by the researcher to chart data from the advanced practice (1) competency frameworks and (2) education curricula. The first proforma included: title, country of origin, health disciplines and list of competencies. The second proforma included: university profile details, programme title, level of education and compulsory and optional module titles relevant to MSK physiotherapists.

2.5. Data analysis

Inductive (i.e., codes derived from the text) and deductive (i.e., pre-devised categories) content analysis (Bos and Tarnai, 1999; Hsieh and Shannon, 2005) was utilised to review the competency frameworks and education curricular content, as utilised in similar research (O’Donoghue et al., 2011). There were two stages of content analysis: (1) competencies and (2) education curricular modules.

In Stage 1, an initial coding tree was derived iteratively from the international advanced practice competency frameworks by two researchers [a physiotherapist and MSK physiotherapy educator and researcher]. Each code was analysed thoroughly to ensure it represented the competencies included (Fig. 2).

For Stage 2, the codes identified during Stage 1 were applied to the modules from the curricula independently by the same two researchers. Discussion between the researchers resulted in the expansion and collapse of some of the initial codes, resulting in final consensus (Fig. 2).

Survey data were inputted onto Excel (Microsoft Office 365) for analysis. Descriptive statistics were used to analyse the number of physiotherapists who ranked each learning topic as high priority for an
**Results**

### 3.1. Advanced practice competency frameworks

Six APP competency frameworks were identified from the search of the literature (Harding et al., 2015; Jones et al., 2015) and websites; four from the UK and two from Australia (Table 2). All four UK frameworks were based on the four pillars of advanced practice (Clinical Practice, Facilitating Learning, Leadership, and Evidence, Research and Development) of which, one was MSK-specific (NH Education for Scotland, 2012), three spanned disciplines (Welsh Government, 2011; NHS Education for Scotland, 2012; National Health Service (NHS), 2017) and one was specific to physiotherapists (Chartered Society of Physiotherapists, 2016). These frameworks have been utilised to demonstrate evidence of competence and CPD, to support career progression and professional body registration and accreditation, and to inform job descriptions (Chartered Society of Physiotherapists, 2016; Moloney et al., 2009; Jones et al., 2015; NHS Education for Scotland, 2012). The Scottish and Welsh frameworks provided self-assessment forms which asks the advanced practitioners to rate themselves on each competency and provide evidence to support this decision (Moloney et al., 2009; Jones et al., 2015), with the Welsh framework also providing a 360-degree feedback form to be completed by colleagues (Moloney et al., 2009).

Only the Australian frameworks were specific to MSK APPs and also provided ‘specific-to-practice’ competencies for different MSK settings (emergency departments, post arthroplasty review clinics, orthopaedic and neurosurgical physiotherapy-led screening clinics, spinal screening, post surgical, rheumatology, osteoarthritis hip and knee service, and specialist physiotherapy pain clinics) (Department of Health, 2014;Australian Physiotherapy Association, 2019). Additionally, a more formalised assessment was provided which must be conducted with a clinical mentor (i.e., APP with a minimum of two years-experience or medical consultant within their specialty) (Goodman et al., 2016). Despite the discrepancies between these frameworks, common themes emerged regarding the included competencies; Professional-related Matters (e.g., scope of practice, governance systems), Clinical Reasoning and Decision-making, Education, Clinical Skills, Assessment and Communication (with colleagues) and Communication (with patients). Themes of Research, Evidence-based Practice, Clinical Mentoring, Leadership and Service Development, were only identified in the UK frameworks.

### 3.2. MSK APP university-led education curricula

Eleven advanced practice education curricula relevant to MSK physiotherapists were identified from the search of the literature (Goodman et al., 2018; Lundon et al., 2008, 2011, 2013; Lineker et al., 2011; Warmington et al., 2015) and university websites; predominantly UK-based (n = 9), one in Australia and another in Canada [Appendix]. Reflecting the competency frameworks, these education programmes targeted multiple disciplines and specialities, with only three programmes specific to physiotherapy. Both the Australian and Canadian APP MSK education curricula led to a Diploma qualification, whereas the UK education programmes could be completed to achieve a Masters. Pre-requisites for entering the APP education programmes varied from a minimum 10 months (full time) to five years of clinical experience and some courses required the prospective students to demonstrate support of their line manager and a designated mentor.

Based on the titles of compulsory and optional modules deemed relevant to MSK physiotherapy, the same themes were identified as in the above competency frameworks. However, some of these were expanded or collapsed to cover the module topics; Assessment (Assessment and Diagnosis and Radiology) and Clinical Skills (Pharmacology, Injection Therapy, Clinical MSK Physiotherapy Skills). Research and Evidence-based Practice was evident in all but one education curriculum, and Assessment and Diagnosis, Pharmacology, Leadership and Service Management, and Professional-related matters were identified across more than 60% of education curricula (Table 3) but varied between being mandatory or optional in each education programme. Less common across the education curricula (≥40%) were Injection Therapy, Communication and Interpersonal Skills, Radiology, and Education and Clinical Mentoring (Table 3).

### 3.3. Survey of physiotherapists in Ireland

The learning priorities survey was completed by 25 physiotherapists in attendance at the APP symposium, including those already operating at an advanced practice level (n = 14). Over 70% of the participating physiotherapists ranked the following themes as high priority: Radiology, Assessment and Diagnosis, Clinical Reasoning and Decision-making, and Research and Evidence-based Practice (Table 4). However, some of the learning priorities under these themes were not rated as highly such as Haematology and Shared Decision-making. Additionally, learning priorities under Clinical MSK Physiotherapy were often not considered to be of high priority with less than 16% of physiotherapists deeming Manual Therapy to be of high priority for an APP education curriculum.

### 4. Discussion

#### 4.1. Main findings

This study provides an in-depth review of international APP MSK competency frameworks and education curricula for the first time, and identified the common themes relating to professional and clinical capabilities expected of MSK APPs internationally. Additionally, learning priorities under each of these themes were ranked as high by physiotherapists in Ireland. Despite the variances existing in advanced practice physiotherapy both between and within countries (Fennelly et al., 2017), findings indicate that it would be feasible to adopt standardised MSK APP competencies and education standards using the common themes identified in this study as a foundation, as advocated for by the World Confederation of Physical Therapists (2019). This would likely enhance workforce mobility, role legitimacy and service quality, and facilitate lobbying for recognition and remuneration (Distler, 2007).

#### 4.2. Clinical advanced practice competencies

Learning priorities which were perhaps considered to be entry-level physiotherapy skills, such as Exercise Prescription, Manual Therapy and Shared Decision-making, were not deemed by many of the surveyed physiotherapists to be of high priority for a MSK APP education curricula.
Table 2
Identified international competency and/or capability frameworks which encompass advanced practice physiotherapy.

| Framework for Advanced Nursing, Midwifery and Allied Health Professional Practice in Wales | Wales | Nursing, midwives, physiotherapists, occupational therapists. | 1. Management and Leadership |
|-----------------------------------------------|---|-------------------------------------------------|-----------------------------|
|                                              | | | 1.1. Change management |
|                                              | | | 1.2. Negotiation & influencing skills |
|                                              | | | 1.3. Networking |
|                                              | | | 1.4. Team development |
|                                              | | | 2. Education |
|                                              | | | 2.1. Principles of teaching and learning |
|                                              | | | 2.2. Supporting others |
|                                              | | | 2.3. Promotion of learning |
|                                              | | | 2.4. Career teaching & information giving |
|                                              | | | 2.5. Developing education materials |
|                                              | | | 2.6. Teaching, mentorship & coaching |
|                                              | | | 3. Research |
|                                              | | | 3.1. Access information systems |
|                                              | | | 3.2. Critical appraisal |
|                                              | | | 3.3. Audit/service development |
|                                              | | | 3.4. Implement research findings |
|                                              | | | 3.5. Presentations & publications |
|                                              | | | 4. Advanced Clinical Practice |
|                                              | | | 4.1. Decision-making & problem-solving |
|                                              | | | 4.2. Critical thinking & analytical skills |
|                                              | | | 4.3. Managing complexity |
|                                              | | | 4.4. Clinical governance |
|                                              | | | 4.5. Equality and diversity |

| AHPs Advanced Practice Education and Development Framework (Musculoskeletal) | Scotland | Physiotherapists, occupational therapists, radiographers, chiropodists & podiatrists. | 1. Clinical Practice |
|---------------------------------------------------------------------------|---------|---------------------------------------------------------------------------------|---------------------|
|                                                                          |         | 1.1. Communicate effectively |
|                                                                          |         | 1.2. Collect information |
|                                                                          |         | 1.3. Interpret information & clinical decision-making |
|                                                                          |         | 1.4. Take appropriate action |
|                                                                          |         | 1.5. Promote health and well-being |
|                                                                          |         | 1.6. Operate within scope of practice |
|                                                                          |         | 2. Facilitating Learning |
|                                                                          |         | 2.1. Learning environment |
|                                                                          |         | 2.2. Facilitation of learning |
|                                                                          |         | 2.3. Quality assurance |
|                                                                          |         | 2.4. Service improvement |
|                                                                          |         | 3. Leadership |
|                                                                          |         | 3.1. Self |
|                                                                          |         | 3.2. Team |
|                                                                          |         | 3.3. Organisation |
|                                              |         | 4. Research |
|                                              |         | (e.g., evidence-based practice; service evaluation; research; governance issues) |

| Multi-professional framework for advanced clinical practice in England | England | Nursing, pharmacy, paramedics, occupational therapy, physiotherapy etc. | 1. Clinical Practice |
|------------------------------------------------------------------------|---------|--------------------------------------------------------------------------|---------------------|
|                                                                        |         | 1.1. Professional conduct |
|                                                                        |         | 1.2. Scope of practice |
|                                                                        |         | 1.3. Professional judgement |
|                                                                        |         | 1.4. Assessment methods (e.g., diagnostic tests) |
|                                                                        |         | 1.5. Effective communication skills |
|                                                                        |         | 1.6. Clinical reasoning and decision-making |
|                                                                        |         | 1.7. Interventions (e.g., prescribing medications; lifestyle advice) |
|                                                                        |         | 1.8. Manage risk appropriately |
|                                                                        |         | 1.9. Work collaboratively |
|                                                                        |         | 1.10. Clinical role model |
|                                                                        |         | 1.11. Subject-specific competencies |
|                                                                        |         | 2. Leadership and Management |
|                                                                        |         | 2.1. Develop effective relationships |
|                                                                        |         | 3. Interacting |
|                                                                        |         | 3.1. Communicating |
|                                                                        |         | 3.2. Helping others learn and develop |
|                                                                        |         | 4. Promoting integration and teamwork |
|                                                                        |         | 4.1. Integration and teamwork |
|                                                                        |         | 4.2. Person-centred practice |
|                                                                        |         | 4.3. Respecting and promoting diversity |
|                                                                        |         | 5. Problem-solving and decision making |
|                                                                        |         | 5.1. Ensuring quality |
|                                                                        |         | 5.2. Improving & developing services |
|                                                                        |         | 5.3. Lifelong learning |
|                                                                        |         | 5.4. Practice decision-making |
|                                                                        |         | 5.5. Researching and evaluating practice |
|                                                                        |         | 5.6. Using evidence to lead practice |

| Advanced practice physiotherapy: an evaluation tool | United Kingdom | Physiotherapy | 1. Physiotherapy Knowledge |
|----------------------------------------------------|---------|---------------|---------------------------|
|                                                     |         |               | 1.1. Relevant to the area of practice & scope of practice |
|                                                     |         |               | 1.2. Political, social, economic & institutional factors |
|                                                     |         |               | 1.3. Self-awareness |
|                                                     |         |               | 2. Physiotherapy practice skills |
|                                                     |         |               | 3. Interacting |
|                                                     |         |               | 3.1. Communicating |
|                                                     |         |               | 3.2. Helping others learn and develop |
|                                                     |         |               | 4. Promoting integration and teamwork |
|                                                     |         |               | 4.1. Integration and teamwork |
|                                                     |         |               | 4.2. Person-centred practice |
|                                                     |         |               | 4.3. Respecting and promoting diversity |

(continued on next page)
However, the importance of enhancing these skills for APPs should not be underestimated, with a recent study highlighting the value patients place upon the unique combination of advanced MSK knowledge and management skills available from attending an APP, and the importance of shared decision-making (Fennelly et al., 2020). Conversely, tasks often deemed to be traditionally-medically controlled such as Radiology and Pharmacology, were frequently prioritised. Clinical imaging decision-making and related communications have also been reported as integral to APP practice in Ireland (Fennelly et al., 2018b; O Mahony et al., 2016), despite prescription of ionising radiation and medications being outside the physiotherapy scope of practice. Such legislative barriers also exist in other countries with only physiotherapists in certain regions of Canada and Australia permitted to order clinical imaging (Chong et al., 2015), whereas in the UK, in addition to diagnostic imaging rights, trained physiotherapists can also prescribe certain medications (Chartered Society of Physiotherapists, 2012). These variances in scope of practice, existing both across and within countries, renders standardised education and competencies as

### Table 2 (continued)

| Framework | Country | Disciplines | Competencies/Capabilities |
|-----------|---------|-------------|---------------------------|
| **Advanced Musculoskeletal Physiotherapy Clinical Education Framework** | **Australia (Victoria)** | **Physiotherapy** | 2.1. Profession-specific practice skills  
2.2. Practical and technical skills shared with others  
1. **Professional Behaviours**  
1.1. Operate within scope of practice  
1.2. Accountability  
2. **Lifelong Learning**  
2.1. Demonstrate a commitment to lifelong learning  
3. **Communication**  
3.1. With colleagues  
4. **Provision and Coordination of Care**  
4.1. Evaluate referrals  
4.2. Perform health assessment/examination  
4.3. Apply the use of radiological investigations  
4.4. Apply the use of pathology tests (under direction and supervision of a consultant)  
4.5. Apply the use of therapeutic medicines (under direction and supervision of a consultant)  
4.6. Apply advanced clinical decision-making  
4.7. Formulate and implement a management plan  
4.8. Monitoring and escalation  
4.9. Obtain patient consent  
4.10. Document patient information  
5. **Specific to practice competencies**  
- Fractures and simple joint reductions  
- Basic wound care  
- Paediatric MSK conditions  
- MSK conditions in patients with diabetes  
- Acute and persistent pain conditions  
- OA of hip or knee  
- Following THR or TKR  |
| **APA National Advanced Musculoskeletal Physiotherapy Competency Framework: Standard of Practice** | **Australia** | **Physiotherapy** | 1. **Professional Behaviours**  
1.1. Operate within scope of practice  
1.2. Display accountability  
2. **Lifelong learning**  
2.1. Demonstrate a commitment to lifelong learning  
3. **Communication**  
3.1. With colleagues  
3.2. With patients  
4. **Provision and Coordination of Care**  
4.1. Evaluate referrals  
4.2. Construct and perform assessments  
4.3. Apply the use of radiological investigations  
4.4. Apply the use of pathology tests  
4.5. Apply the use of therapeutic medicine  
4.6. Apply advanced clinical decision making to formulate differential diagnoses  
4.7. Formulate and implement management plans  
4.8. Evaluate and appraise a patient with complex morbidities  
4.9. Evaluate and appraise in the context of a paediatric patient  
4.10. Monitor and escalate care  
5. **Effective component specific to clinical setting:**  
5.1 Evaluate and appraise patients within a specific cohort  
5.2 Formulate management plans for patients within a specific cohort  
5.3 Provide basic wound care for patients in a specific cohort - Emergency - Orthopaedics - Spinal - Post Surgical - Rheumatology |

| Themes | University Programmes (n = 11) |
|--------|-------------------------------|
| Research and Evidence-based practice | 90.9 (10) |
| Assessment and Diagnosis | 81.8 (9) |
| Pharmacology | 81.8 (9) |
| Clinical MSK Physiotherapy | 72.7 (8) |
| Leadership and Service Management | 72.7 (8) |
| Clinical Reasoning and Decision-making | 63.6 (7) |
| Professional-related Matters | 63.6 (7) |
| Education and Clinical Mentoring | 36.4 (4) |
| Radiology | 27.3 (3) |
| Communication and Interpersonal Skills | 18.2 (2) |
| Injection Therapy | 18.2 (2) |

**Note:** Modules related to neurology and/or respiratory were excluded. Both compulsory and non-compulsory modules were included.
challenging. However at the same time, education providers endeavour to deliver programmes that prepare graduates for work in an evolving system (Crane and Delany, 2013), and pharmacological knowledge and ability to interpret investigations may still be important to APPs irrespective of legislation.

### 4.3. Professional advanced practice competencies

As highlighted earlier, consistency in advanced practice competencies facilitates workforce mobility and transferability of skills but discrepancies currently exist. Leadership, which is considered an important competency when undertaking an advanced practice role (McGowan et al., 2018), is not included as a competency in either the Australian MSK APP competency frameworks (Australian Physiotherapy Association, 2019, Department of Health, 2014) or recent exploratory studies of APPs in primary care (Suckley, 2012; Langridge, 2019). Similarly, APPs are asked to mentor their colleagues as part of several of the education programmes, however, developing the competencies of Clinical Mentoring and Communication were rarely identified within the education curricula or as high priority for education by the surveyed physiotherapists. Perhaps, these skills do not need to be specific modules but they should be incorporated across the post-graduate education programme (Madi et al., 2019).

### 4.4. Education provision

Whilst this study included only MSK education curricula and competency frameworks specific to advanced practice, many others exist which cover many of the same competencies. This includes the Musculoskeletal Core Capabilities Framework for First Point of Contact Practitioners (UK) (Health Education England, 2018) and the International Federation of Manual Physical Therapists (IFOMPT) Educational Standards in Orthopaedic Manipulative Therapy (IFOMPT, 2016). As the IFOMPT standards already provide an internationally-recognised governance framework for MSK physiotherapy education, adoption of this framework to encompass the additional identified competencies would perhaps facilitate the expansion of MSK post-graduate offerings. Given the high level of CPD and graduate qualifications of physiotherapists seeking the additional advanced level competencies (Fennelly et al., 2018b), flexibility within education programmes, which might include recognition of prior learning (Landon and Shupak, 2018), is recommended. As is provision of funding and support of health system management for completion of this education, as happens for other professions to support workforce planning. Other aspects of education provision include experiential learning, which has long been deemed an important component of APP training (Stevenson et al., 2020; Fennelly et al., 2018b; Gilmore et al., 2011; Weatherley and Hourigan, 1998; Ellis et al., 2005), and interprofessional learning which was common place across the identified education curricula. Interprofessional learning and cross-disciplinary advanced practice competencies are often utilised and can improve the quality of care (WHO, 2010) and may promote standardisation and recognition of the use of the ‘advanced practice’. However, this has also led to more generic and ambiguous competencies, and the different levels of autonomy between professions may present challenges e.g., physiotherapists operate as first contact practitioners.

### 4.5. Strengths and limitations

This study included a broad search of the international literature and websites, as well as consultation with international experts. Although the learning priorities for MSK APP education curricula were reviewed by only a subgroup of physiotherapists in Ireland and may not be generalisable, the learning topics included in the study were informed by the international MSK APP literature and experts, and APPs in Ireland have similar education levels and undertake similar tasks to APPs in the UK, Australia and Canada (Fennelly et al., 2017, 2018b). Expansion of this survey to other jurisdictions and stakeholders (e.g., consultant doctors, managers, educators, physiotherapy bodies) would build on these findings to inform international APP education models taking local context, legislation and professional scope of practice into account.
Ethical approval

The Human Research Ethics Committee at University College Dublin approved conduct of this study (LS-E-19-82-Fennelly-Cunningham).

Funding

Not applicable.

Acknowledgements

This project was in part supported by F. Desmeules’ Canadian Institutes Health Research (CIHR) Young Investigator in Rehabilitation Award.

Appendix

Database Search Strategy

| Database   | Search Strategy                                                                                                                                   |
|------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| PubMed     | “Physical Therapists”[Mesh] OR “Physical Therapy Specialty”[Mesh] OR Physiotherapy OR Physiotherapist OR “Physical Therapy” OR “physical Therapist” AND “Advanced practice” OR “extended scope” OR “extended role” OR “advanced clinician” OR “advanced practitioner” AND “Education”[Mesh] OR “Teaching”[Mesh] OR “Curriculum”[Mesh] OR “Competency-Based Education”[Mesh] OR “Clinical Competence”[Mesh] OR education OR training OR teaching OR curriculum OR curricula OR competency OR competencies OR capability |
| CINAHL     | (MH “Physical Therapy”[Mesh]) OR Physiotherapy OR Physiotherapist OR “Physical Therapy” OR “physical Therapist” AND “Advanced practice” OR “extended scope” OR “extended role” OR “advanced clinician” OR “advanced practitioner” AND (MH “Clinical Competence”[Mesh]) OR (MH “Professional Competence”[Mesh]) OR (MH “Curriculum”[Mesh]) OR (MH “Education”[Mesh]) OR education OR training OR teaching OR curriculum OR curricula OR competency OR competencies OR capability |

Note: MeSH, Medical Subject Heading in PubMed; MH, Subject Heading in CINAHL; +, Term exploded in CINAHL.

Appendix

| University                      | Programme Title                              | Core Modules                                                                 | Optional Modules                                                                 |
|---------------------------------|----------------------------------------------|------------------------------------------------------------------------------|----------------------------------------------------------------------------------|
| University of Toronto           | Advanced Clinician Practitioner in Arthritis Care (ACPAC) Program | Basic Science, Theory Underlying Musculoskeletal Practice, Therapeutic Management, Rheumatology, Musculoskeletal and arthritis care electives (x2) | N/A                                                                              |
| University of Canberra          | Postgraduate Diploma in Extended Scope Physiotherapy | Injection therapy, Pharmacology, Radiology, Leadership, Evidence based practice, Clinical Practice | N/A                                                                              |
| Coventry University             | MSc Advanced Clinical Practice               | Advanced Practice Clinical Health Assessment, Advanced Clinical Practice, Clinical Competence for Advanced Health Assessment and Decision-making, Clinical Competence for Advanced Clinical Practice, Clinical Leadership, Research methodology, design and methods Independent Advancing Practice Project | Ethics and Law for Professional Practice, Non-Medical Prescribing, Independent Study, Supporting learning and assessment in health and social care settings, Contemporary perspectives of care for individuals with long term conditions, Managing minor injury and illness |
| Cardiff University              | MSc in Advanced Clinical Practice            | Advanced Clinical Practice Portfolio, exemplifying Evidence-based practice Research methods and health improvement in health and social care | Study skills, Facilitating Learning and Teaching, Ethics in Health and Social Care, Musculoskeletal Diagnosis and Treatment Foundation in Advanced Clinical Assessment for Healthcare Professionals, Evidencing Learning in Specialist Professional Practice Public Health, Health Economics and Policy Research methods and data analysis, Decision-making and managing complex care, Clinical Patient Assessment for Health Professionals, Patient Safety and Clinical Risk Non-Medical Prescribing, Transforming Care, Systems and Services through Leadership |
| University of Liverpool         | Advanced Practice in Healthcare MSc/PGDip/PGCert | Overview of Research Methodologies for Health Professionals, Dissertation, Context of Advanced Practice | Facilitating Practice Based Learning (Mentorship Preparation), Development of Leadership Skills in Health and Social Care |

(continued on next page)
| University | Programme Title                                      | Core Modules                                                                 | Optional Modules                                                                                       |
|------------|------------------------------------------------------|-------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|
| University of Nottingham | Advanced Clinical Skills                            | History Taking Clinical Examination and Decision-making | Negotiated Work Based Learning - Developing Practice Skills  
Mentorship Through Action Learning in Health and Social Care  
Concepts of Management in Musculoskeletal Trauma  
Clinical Skills and Diagnostics adult Musculoskeletal Leg  
Critical Clinical Reasoning and Thinking for Healthcare Professionals  
Diagnosis & Triage of Upper Limb Musculoskeletal Conditions;  
Managing Complexity in Clinical Environments  
Supporting Learning in Professional Practice (Multi-professional Support of Learning and Assessment in Practice)  
Non-medical Prescribing Practice (independent and Supplementary Prescribing)  
Essentials of Pharmacology for Non-Medical Prescribing Principles and Practice of Qualitative Research  
Impact of Human Factors and Ergonomics on Patient Safety in Healthcare  
Clinical Education (practice & Theory) for Orthoptists  
Diagnosis and Triage of Lower Limb Musculoskeletal Disorders  
The Diagnosis and Triage of Spinal Musculoskeletal Conditions  
Practical Aspects of Image Guidance for Radiotherapy  
Generating and Using Professional Evidence  
Practice Educators Introductory Course  
Therapeutic Communication Skills for Advanced Practice Leadership in Professional Practice |
| University of Southampton | Advanced Clinical Practice (Advanced Allied Health Practitioner) | Research Methods for Evidence Based Practice  
History Taking and Physical Assessment Across the Lifespan  
Diagnostic Assessment and Decision-Making; Pharmacology and Prescribing in Clinical Practice  
Transition to Advanced Practice (Advanced Nurse Practitioner and Advanced Allied Health Practitioner); Dissertation | N/A |
| University of Birmingham | Advanced Clinical Practice and new programme Advanced Practice in Healthcare (Global) MSc/PGDip/PGCert | Advanced Health Assessment and Clinical Decision-Making  
Project Management and Research Governance Leadership in Advanced Clinical Practice Research Project/Dissertation | Prescribing: scientific principles and safe practice  
Prescribing: safe effective practice  
Quantitative Methods in Healthcare  
Mixed Methods Research Designs  
Current Issues in Health  
Introduction to Leadership and Management for Health Care Evaluation and Commissioning  
Qualitative Research Methods  
Systematic Reviews and Evidence Synthesis  
Epidemiology Statistics and Research Methods |
| University of Plymouth | Advanced Professional Practice in Physiotherapy       | Applying Evidence to Practice Project Design for Research Research Dissertation  
Physiotherapy Practice Supported Study | Injection Therapy for Health Professionals (Botulinum Toxin)  
Injection Therapy for Health Professionals (Corticosteroid)  
Pathomechanics and Rehabilitation of Gait and Balance  
Advanced Critical Reflection, Risk and Decision-Making International Perspectives and Practice Requirements for Health and Social Care Practitioners  
Assessment and Management of Foot and Lower Limb Musculoskeletal Conditions; Facilitating Collaborative Patient Management and Flow  
Leading Professionals, Managing Aspirations for Self and Others  
Innovation in an Ever Changing Marketplace - Entrepreneurship for Health and Social Care Professionals  
Advanced Clinical Reasoning in Musculoskeletal Conditions |

(continued on next page)
| University      | Programme Title          | Core Modules                  | Optional Modules                                                                 |
|-----------------|--------------------------|--------------------------------|-----------------------------------------------------------------------------------|
| Queen Margaret  University | Advancing Practice in Health Framework | N/A                            | Advanced Competencies (pre agreed work place competencies)                        |
|                 |                          |                                | Assessment and Feedback (educational role - variety of assessment and feedback methods) |
|                 |                          |                                | Community Health and Wellbeing Theory                                             |
|                 |                          |                                | Diagnostic Investigations for Current Practice                                   |
|                 |                          |                                | Dissertation                                                                      |
|                 |                          |                                | Delivering Impact in Practice                                                     |
|                 |                          |                                | Enquiry-based Practice (research principles, methodologies and analysis)           |
|                 |                          |                                | Facilitating Learning                                                             |
|                 |                          |                                | Fundamentals of Advancing Practice                                               |
|                 |                          |                                | Leadership and Business Management                                               |
|                 |                          |                                | Management of Diabetes and its Complications                                      |
|                 |                          |                                | MRU/CT in Practice                                                                |
|                 |                          |                                | Medical Imaging of the Foot and Ankle                                            |
|                 |                          |                                | Non-medical Prescribing for Allied Health Professions                             |
|                 |                          |                                | Principles of MRU/CT                                                              |
|                 |                          |                                | Principles of Diabetes and its Complications                                      |
|                 |                          |                                | Realistic medicine (interventions improve health outcomes related to lifestyle behaviours) |
|                 |                          |                                | Tissue viability                                                                  |
|                 |                          |                                | Leadership, Management and Professional Issues                                   |
|                 |                          |                                | Applied Pharmacology for Non-medical prescribing                                 |
|                 |                          |                                | Clinical decision-making for Non-medical prescribing                              |
|                 |                          |                                | Emergency and Unscheduled Care                                                    |
|                 |                          |                                | Minor Injury Management                                                           |
| Bucks New       University | MSc Advanced Clinical Practitioner | Physical Assessment of the Adult |                                                                                |
|                 |                          | Clinical Reasoning Skills for Advanced Practice                                |                                                                                |
|                 |                          | Generating Knowledge for Practice                                            |                                                                                |
|                 |                          | Dissertation                                                                   |                                                                                |

References

Ardoin, S.P., Daly, R.P., Merzouq, L., Tse, K., Ardalan, K., Arkin, L., et al., 2019. Research priorities in childhood-onset lupus: results of a multidisciplinary prioritization exercise. Pediatric Rheumatol. online J 17 (1), 32.

Arkey, H., O Malley, L., 2005. Scope changes: towards a methodological framework. Int. J. Soc. Res. Methodol. 8 (1), 19–32.

Australian Physiotherapy Association, 2019. APA National Advanced Musculoskeletal Physiotherapy Competency Framework: Standard of Practice. Australian Physiotherapy Association. https://australian-physio/sites/default/files/APA_National_AMP_Competency_Standard_Draft_v1.01.pdf.

Australian Physiotherapy Association (APA), 2009. Australian Physiotherapy Association Position Statement on Scope of Practice.

Bergstrom, P., Lindh, V., 2018. Developing the role of Swedish advanced practice nurse (APN) through a blended learning master’s program: consequences of knowledge organisation. Nurse Educ. Pract. 28, 196–201.

Bevan, S., McGee, R., Quadrello, T., 2009. Fit for Work? Musculoskeletal Disorders and Exercise. Pediatric Rheumatol. online J 17 (1), 32.

Broome, K., 2015. Is it time for an Australian advanced practice framework to improve quality of care and preserve health care resources. Phys. Ther. 95 (10), 827–829. https://doi.org/10.1093/ptj/puy080.

Bromme, K., 2015. Is it time for an advanced Australian practice framework for occupational therapists? Aust. Occup. Ther. J. 62 (3), 210–213.

Byles, S.E., RSM, L., 1989. Orthopaedic out-patients - a fresh approach. Physiotherapy 75, 435–437.

Chartered Society of Physiotherapists. Physiotherapists gain new power to prescribe medicines independently after campaigning by CSP 2012 [cited 2017 15th March]. Available from: http://www.csp.org.uk/press-releases/2011-07-24-physiotherapists-gain-new-power-prescribe-medicines-independently-after-ca.

Chartered Society of Physiotherapists, 2016. Advanced Practice in Physiotherapy: Understanding the Contribution of Advanced Practice in Physiotherapy to Transforming Lives, Maximising Independence and Empowering Populations.

Chartered Society of Physiotherapists. Advanced clinical practice apprenticeship is on the cards 2017 [cited 2017 17th April]. Available from: https://www.csp.org.uk/news/2017-04-25-advanced-clinical-practice-apprenticeship-cards.

Chong, J.N., De Luca, K., Goldan, S., Imam, A., Li, B., Zabjek, K., et al., 2015. Ordering diagnostic imaging: a survey of Ontario physiotherapists’ opinions on an expanded scope of practice. Physiother. Can. 67 (2), 144–156.

Crane, J., Delany, C., 2013. Physiotherapists in emergency departments: responsibilities, accountability and education. Physiotherapy 99 (2), 95–100.

Curley, A.E., Cassells, M., Cooke, G., Dowling, F., 2004. Physiotherapy-led low back pain triage: results of the first two years. Physiotherapy Ireland 25 (2), 5–9.

Daker-White, G., Carr, A.J., Harvey, I., Woolhead, G., Bannister, G., Nelson, L., et al., 1999. A randomised controlled trial. Shifting boundaries of doctors and physiotherapists in orthopaedic outpatient departments. J. Epidemiol. Community Health 53 (10), 643–650.

Dawson, L.J., Ghazi, F., 2004. The experience of physiotherapist extended scope practitioners in orthopaedic outpatient clinics. Physiotherapy 90 (4), 210–216.

Department of Health, 2014. Advanced Musculoskeletal Physiotherapy Clinical Education Framework. Victorian Government, Melbourne. http://www.health.vic.gov.au/ampworkforce/docs/amp-clinical-ed-framework.pdf.

Dawson, L.J., Ghazi, F., 2004. The experience of physiotherapist extended scope practitioners in orthopaedic outpatient clinics. Physiotherapy 90 (4), 210–216.

Dawson, L.J., Ghazi, F., 2004. The experience of physiotherapist extended scope practitioners in orthopaedic outpatient clinics. Physiotherapy 90 (4), 210–216.

Dawson, L.J., Ghazi, F., 2004. The experience of physiotherapist extended scope practitioners in orthopaedic outpatient clinics. Physiotherapy 90 (4), 210–216.

Dawson, L.J., Ghazi, F., 2004. The experience of physiotherapist extended scope practitioners in orthopaedic outpatient clinics. Physiotherapy 90 (4), 210–216.

Dawson, L.J., Ghazi, F., 2004. The experience of physiotherapist extended scope practitioners in orthopaedic outpatient clinics. Physiotherapy 90 (4), 210–216.

Dawson, L.J., Ghazi, F., 2004. The experience of physiotherapist extended scope practitioners in orthopaedic outpatient clinics. Physiotherapy 90 (4), 210–216.

Dawson, L.J., Ghazi, F., 2004. The experience of physiotherapist extended scope practitioners in orthopaedic outpatient clinics. Physiotherapy 90 (4), 210–216.

Dawson, L.J., Ghazi, F., 2004. The experience of physiotherapist extended scope practitioners in orthopaedic outpatient clinics. Physiotherapy 90 (4), 210–216.

Dawson, L.J., Ghazi, F., 2004. The experience of physiotherapist extended scope practitioners in orthopaedic outpatient clinics. Physiotherapy 90 (4), 210–216.

Dawson, L.J., Ghazi, F., 2004. The experience of physiotherapist extended scope practitioners in orthopaedic outpatient clinics. Physiotherapy 90 (4), 210–216.

Dawson, L.J., Ghazi, F., 2004. The experience of physiotherapist extended scope practitioners in orthopaedic outpatient clinics. Physiotherapy 90 (4), 210–216.

Dawson, L.J., Ghazi, F., 2004. The experience of physiotherapist extended scope practitioners in orthopaedic outpatient clinics. Physiotherapy 90 (4), 210–216.

Dawson, L.J., Ghazi, F., 2004. The experience of physiotherapist extended scope practitioners in orthopaedic outpatient clinics. Physiotherapy 90 (4), 210–216.

Dawson, L.J., Ghazi, F., 2004. The experience of physiotherapist extended scope practitioners in orthopaedic outpatient clinics. Physiotherapy 90 (4), 210–216.

Dawson, L.J., Ghazi, F., 2004. The experience of physiotherapist extended scope practitioners in orthopaedic outpatient clinics. Physiotherapy 90 (4), 210–216.
