Pharmacy Education (2025) 25(1) 502 - 513
https://doi.org/10.46542/pe.2025.251.502513

RESEARCH ARTICLE

Bachelor of Pharmacy syllabi in South Africa: Missed opportunity for multidisciplinary management of musculoskeletal conditions

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Keywords
Healthcare team
Integration of pharmacist
Interprofessional education
Joint disease
Non-pharmacological management
Referral by pharmacist

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Abstract

Background: Musculoskeletal (MSK) conditions decrease quality of life and burden healthcare systems. Pharmacists are well placed to reduce the burden on the healthcare system and contribute to multidisciplinary teams. Pharmacy graduates need to possess the knowledge and skills to seamlessly collaborate with multidisciplinary teams by understanding the role of other healthcare professionals (HCPs). Thus, this study aimed to evaluate whether the various offerings of the South African Bachelor of Pharmacy (BPharm) degree effectively familiarise graduates with other HCPs and their roles using MSK conditions as a theme. **Methods:** A comparative cross-sectional desktop review was conducted across all nine South African universities offering the BPharm degree. Curriculum documents and teaching materials were analysed using qualitative content analysis. Themes were identified using open coding. **Results:** The commonly covered MSK conditions were gout, osteoarthritis, rheumatoid arthritis, trauma, and sports-related injuries. All universities addressed non-pharmacological management. Physiotherapists, medical doctors, and occupational therapists were the most frequently mentioned HCPs, however, only one university addressed their roles and responsibilities. **Conclusion:** Graduates often lack clarity on referring MSK cases, hindering interdisciplinary collaboration. To enhance teamwork, interdisciplinary education should be integral to the undergraduate curriculum. Pharmacy syllabi must include healthcare professional roles and non-pharmacological strategies. Accrediting bodies and universities should promote interdisciplinary education and collaboration.

Introduction

The Global Burden of Disease (GBD) studies have reported that non-communicable diseases are on the increase, and musculoskeletal conditions account for a significant amount of this global rise (Blyth *et al.*, 2019). The high prevalence of musculoskeletal disorders has been associated with longer life expectancies, whereby multimorbidity and disability rise with age and sedentary lifestyle (as is seen with sarcopenia) (Blyth *et al.*, 2019; Laguna *et al.*, 2023). These conditions not only lead to a decrease in the quality of life for the patients but also impose a significant burden on healthcare systems (McLachlan *et al.*, 2022).

Pharmacists are healthcare professionals who are well placed to reduce the burden of these conditions on the healthcare system (Thapa *et al.*, 2021). Pharmacists are a trusted source of information for patients and are uniquely positioned to appraise pharmacological and non-pharmacological management of patients (McLachlan *et al.*, 2022). The expanded role of a pharmacist, which follows a patient-centred approach, necessitates their inclusion in the multidisciplinary team in the management of musculoskeletal conditions

(Thapa *et al.*, 2021). This inclusion assists in identifying and appropriately referring the patients when necessary to the relevant healthcare professional (Cottrell *et al.*, 2021). Evidence of pharmacist's involvement in joint pain management in the community pharmacy setting, however, is limited (McLachlan *et al.*, 2022). Furthermore, despite policies that advocate for the inclusion of pharmacists in the multidisciplinary team, pharmacists are often excluded during the implementation of such policies (Dineen-Griffin *et al.*, 2020).

Musculoskeletal conditions provide an ideal context for interprofessional collaboration, due to their high prevalence, chronic nature, and treatment involving both pharmacological and non-pharmacological approaches (Takahashi *et al.*, 2019; McLachlan *et al.*, 2022). These conditions require effective coordination among healthcare professionals, establishing musculoskeletal care as a practical model for examining team-based practices (Harnett & Ung, 2023; Shapovalov *et al.*, 2023). This team may include medical doctors, who typically diagnose and coordinate overall care; physiotherapists, who facilitate physical rehabilitation and mobility; occupational therapists, who assist patients in adapting to daily activities; and biokineticists, who design exercise-based interventions (Gilchrist & Kholvadia, 2023; Nielsen *et al.*, 2025). Podiatrists may be involved in addressing lower limb and foot-related musculoskeletal issues, while chiropractors and osteopaths focus on manual therapies to alleviate pain and enhance function (Umberto, 2023; Tan *et al.*, 2025). Acupuncturists may also play a role through complementary techniques aimed at pain relief (Umberto, 2023; Sim *et al.*, 2024). Pharmacists are increasingly expected to collaborate with these professionals by contributing to medication management, patient education, and timely referrals to ensure holistic and effective care (Takahashi *et al.*, 2019; Harnett & Ung, 2023; Shapovalov *et al.*, 2023).

The need for collaboration amongst healthcare professionals from diverse backgrounds has increased with the rise in complexities in healthcare (Tornqvist *et al.*, 2023). Patients often present with multiple pathologies, and there is a broader array of treatment options available to them (Tornqvist *et al.*, 2023). As a result, they typically seek advice from multiple healthcare professionals concurrently (Tornqvist *et al.*, 2023). It is essential that the evolution and dynamics of interprofessional collaboration are understood by healthcare professionals, particularly new graduates who are expected to be part of a multidisciplinary team throughout their careers, despite this concept not receiving adequate academic attention (Schot *et al.*, 2019; Tornqvist *et al.*, 2023).

Pharmacy graduates are expected to possess the knowledge and skills that enable them to effortlessly integrate into interdisciplinary teams (El-Awaisi *et al.*, 2018). This means that upon graduation, pharmacists will be able to immediately form collaborative partnerships with other healthcare professionals and appropriately refer patients, particularly those with chronic conditions (El-Waisi *et al.*, 2018; Kiles *et al.*, 2022). The evolution of the role of pharmacists has enabled them to transition from traditional dispensing to providing direct patient care (Ayele *et al.*, 2018). This includes managing medications, conducting examinations and screenings, managing chronic conditions, providing medication information and education, collaborating and liaising with other healthcare professionals, including referrals, ensuring quality assurance, and conducting research (Khaira *et al.*, 2020).

The Bachelor of Pharmacy (BPharm) in South Africa is a four-year degree, followed by one year of internship and another year of community service (Mosiane *et al.*, 2022). The BPharm qualification is offered at nine universities, which are accredited by the South African Pharmacy Council (SAPC). The SAPC sets out the minimum standards for accreditation of BPharm programmes through documents such as the Good Pharmacy Education Standards (GPES) and Curriculum Outline and Criteria for Accreditation (SAPC: GPES, 2017; SAPC: Bachelor of Pharmacy Curriculum Outline and Criteria for Accreditation, 2024). Although the SAPC has set out the minimum standards for the qualification, universities have the autonomy to structure their BPharm syllabi, provided that they have demonstrated alignment with the SAPC's thirteen Exit Level Outcomes (ELO's) which are supported by Associated Assessment Criteria (AAC) to guide teaching and student evaluation (SAPC: GPES, 2017; SAPC: GPES, 2019; SAPC: Bachelor of Pharmacy Curriculum Outline and Criteria for Accreditation, 2024). This allows for some variation in the specific modules and content covered; hence, there will be differences in the delivery of the programme by the various universities (SAPC: GPES, 2017; Mosiane *et al.*, 2022).

Despite the recognised importance of interdisciplinary collaboration and the growing burden of musculoskeletal conditions, there is currently a lack of literature exploring the extent to which these conditions are covered in the BPharm syllabi at South African universities. Furthermore, no studies have comprehensively examined the non-pharmacological and complementary management strategies taught within these programmes, nor how the roles of other healthcare professionals are represented in the musculoskeletal modules. This knowledge gap is significant, as pharmacists are increasingly expected to

make meaningful contributions to interdisciplinary care. The integration of interprofessional education within the BPharm curriculum, particularly in a manner that supports collaborative practice in order for graduates to effectively execute their expanded role and refer patients appropriately, remains unexplored. The lack of such research leaves a significant gap in the evidence base essential for informing curriculum development and policy decisions. Critically, there is no available evidence evaluating how effectively the BPharm syllabi prepare pharmacy graduates to refer patients appropriately and collaborate with other healthcare professionals in the management of musculoskeletal conditions. If these areas are underrepresented or poorly integrated into pharmacy education, it may hinder pharmacists' ability to contribute meaningfully to patient care, limit appropriate referrals, and reduce the overall effectiveness of interdisciplinary healthcare teams.

Thus, the aim of this study was to determine whether the BPharm degree offered by South African universities effectively prepares graduates for the role of a pharmacist in managing musculoskeletal conditions. With the goal of enhancing multidisciplinary collaboration, this includes a specific focus on the conditions covered, the inclusion of non-pharmacological treatment approaches, and the mention of other healthcare professionals and their roles in musculoskeletal care.

Methods

Study design

The study was a comparative cross-sectional study, using the National Institute for Health and Care Excellence (NICE) methodology for a systematic comparative desktop review (Garbi, 2021). This design allowed the comparison of curricula across multiple institutions at a single point in time, focusing on the musculoskeletal conditions taught and the extent of interprofessional education integration. To enhance rigour and credibility, the methodology aligns with approaches used in similar curriculum analysis studies (Batt *et al.*, 2018; Maslyankov *et al.*, 2022). The study was approved by the University of Witwatersrand Human Research Ethics Committee (Medical) with clearance certificate number: M220344.

Study setting and selection criteria

The study was conducted across nine universities accredited by the SAPC to offer the BPharm degree in South Africa. These universities represent the full landscape of pharmacy education in South Africa, making the findings generalisable within the South African context.

Data collection

There are nine universities in South Africa which are accredited by the SAPC to offer the BPharm degree. Ethical clearance and/or permission from gatekeepers of these nine universities was obtained, which granted the researcher permission to access the BPharm syllabi on musculoskeletal conditions module(s)/subject(s). The researcher obtained the course materials either by email or through access to the university's learning management system. A desktop evaluation of the syllabi was conducted subsequent to the acquisition of the pharmaceutical care/clinical pharmacy, musculoskeletal conditions, pharmacy practice modules, and other teaching material, such as PowerPoint slides shared with the students. This approach is consistent with other studies (Kerr *et al.*, 2020), which evaluated interprofessional learning content using curriculum documents and faculty-reported syllabi. Microsoft Excel 2021 (Version 16) was utilised to capture various content, and emerging themes were identified within the modules.

Data analysis

Qualitative content analysis was used. The data were coded by anonymising the universities, using unique identifiers (e.g., UNI-1 to UNI-9) to prevent the use of their actual names. Emerging themes and categories were identified and organised into key domains/themes, using open coding, which included musculoskeletal conditions; non-pharmacological management; mentions and descriptions of other healthcare professionals; explicit reference to interprofessional collaboration; and the role of the pharmacist in musculoskeletal care management. Theme validation was conducted through triangulation, involving an independent review by a second coder who identified the themes separately. The results were compared, discrepancies were resolved, and a further peer review was carried out by the researcher's two supervisors. The findings were interpreted through descriptive and narrative statistics for presentation of the results obtained from the universities (Bengtsson, 2016). This was done through frequency counts and percentages to obtain the mean, standard deviation, the minimum and maximum values to determine if there were any correlations in the data.

Results

All nine universities agreed to share material for the study. The musculoskeletal conditions covered in the pharmaceutical care/clinical pharmacy, pharmacy practice, or musculoskeletal conditions modules are indicated in Table I. Osteoarthritis, rheumatoid arthritis, and gout (hyperuricaemia) were included by all the universities.

Table I: Musculoskeletal conditions covered in the relevant modules of the different universities and the percentages

Musculoskeletal condition	UNI-1	UNI-2	UNI-3	UNI-4	UNI-5	UNI-6	UNI-7	UNI-8	UNI-9	Number and percentage (%) of universities covering condition
Ankylosing spondylitis/ Spondylarthritis	-	-	✓	-	✓	-	✓	-	✓	4/9 (44.4%)
Back pain	-	-	✓	-	✓	✓	-	-	-	3/9 (33.3%)
Bursitis	-	-	✓	-	-	✓	-	-	-	2/9 (22.2%)
Calcaneal spur	-	-	✓	-	-	-	-	-	-	1/9 (11.1%)
Carpal tunnel	-	-	✓	-	✓	-	-	-	-	2/9 (22.2%)
Fibromyalgia/fibrositis	-	-	✓	-	✓	✓	-	-	-	3/9 (33.3%)
Gout and Hyperuricaemia	✓	✓	✓	✓	✓	✓	✓	✓	✓	9/9 (100%)
Lupus	-	-	✓	-	-	-	✓	-	✓	3/9 (33.3%)
Muscular dystrophy	✓	-	-	✓	-	-	-	✓	✓	4/9 (44.4%)
Myasthenia gravis	✓	-	-	✓	-	-	-	✓	✓	4/9 (44.4%)
Osteoarthritis	✓	✓	✓	✓	✓	✓	✓	✓	✓	9/9 (100%)
Osteomalacia	✓	✓	-	✓	-	-	-	-	-	3/9 (33.3%)
Osteomyelitis	✓	✓	-	✓	-	-	-	✓	✓	5/9 (55.5%)
Osteoporosis	✓	✓	✓	✓	✓	✓	✓	✓	-	8/9 (88.8%)
Paget's disease	-	-	-	-	✓	-	✓	-	-	2/9 (22.2%)
Plantar fasciitis	-	-	✓	-	-	-	-	-	-	1/9 (11.1%)
Polio	✓	-	-	✓	-	-	-	-	-	2/9 (22.2%)
Polymyositis	-	-	-	-	-	-	✓	-	-	1/9 (11.1%)
Psoriatic arthritis	-	-	✓	-	-	-	✓	-	-	2/9 (22.2%)
Rheumatoid arthritis	✓	✓	✓	✓	✓	✓	✓	✓	✓	9/9 (100%)
Rickets	✓	-	-	✓	-	-	-	✓	-	3/9 (33.3%)
Septic arthritis	-	-	-	-	-	-	✓	-	✓	2/9 (22.2%)
Trauma/Sports related injuries	✓	✓	✓	✓	✓	✓	-	-	-	6/9 (66.6%)
Tendonitis	-	-	✓	-	✓	✓	-	-	-	3/9 (33.3%)
Tetanus	✓	-	-	✓	-	-	-	-	-	2/9 (22.2%)

Table II indicates that all nine universities addressed the non-pharmacological management of these conditions and made reference to topical and complementary alternative medicine (CAMS). The treatment options covered in the modules included various non-pharmacological methods. These included the Rest, Ice, Compression, and Elevation (RICE) method, gold salts, supplements such as calcium, vitamin D & K, nervous system stimulators such as Transcutaneous Electrical Nerve Stimulator (TENS), Action Potential Simulation (APS), Sensory Thalamic Stimulator (STS), Dorsal Column Stimulator (DCS), Peripheral Nerve Stimulator (PNS), acupuncture, chemoneurolysis, aromatherapy, meditation, hydrotherapy and heat/cold, reflexology, ultrasound, hypnosis, bandage therapy and dynamic exercise therapy.

Table II further reports that six out of nine universities (66.6%) make mention of other healthcare

professionals involved in the management of musculoskeletal conditions, while one (11.1%) university mentioned the scope, roles, and responsibilities which the healthcare professionals play. These healthcare professionals are illustrated in Figure 1, which reports that medical doctors, physiotherapists, and occupational therapists were the most commonly mentioned healthcare professionals. A comprehensive list of which universities mentioned which healthcare professionals is demonstrated in Table III, which highlights that Uni-3 and Uni-4 mentioned 6 and 5 healthcare professionals, respectively.

Table II: Non-pharmacological management and inclusion of other healthcare professionals involved in the management of musculoskeletal conditions

	UNI-1	UNI-2	UNI-3	UNI-4	UNI-5	UNI-6	UNI-7	UNI-8	UNI-9	Number and percentage (%)
Does the module cover non-pharmacological management of these conditions?	✓	✓	✓	✓	✓	✓	✓	✓	✓	9/9 (100%)
Does the treatment mention the use of any topical and complimentary alternative medicine (CAMS)?	✓	✓	✓	✓	✓	✓	✓	✓	✓	9/9 (100%)
Is there any mention of other healthcare professionals involved in the management of these conditions?	✓	✓	✓	✓	✓	✓	-*	-*	-*	6/9 (66.6%)
Is the scope, role, and responsibilities of any of the mentioned healthcare professionals described	-	-	✓	-	-	-	-	-	-	1/9 (11.1%)

*Only mentioned in the recommended references

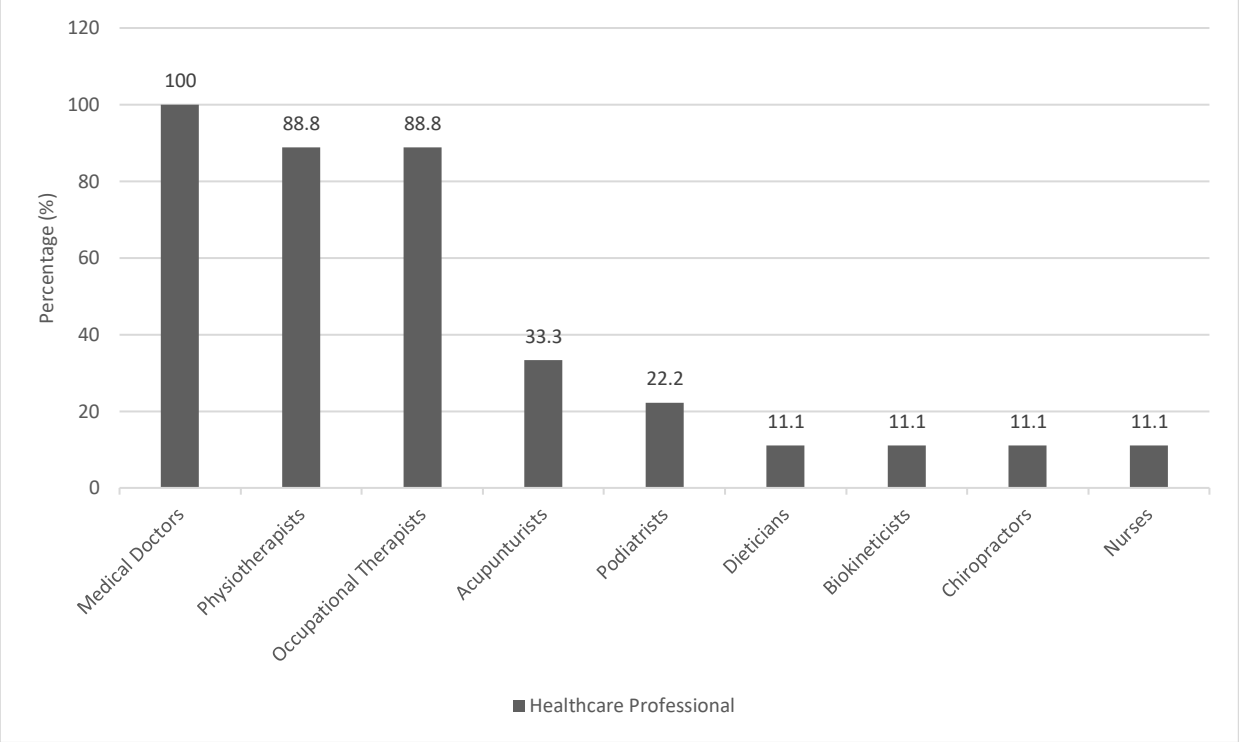

Figure 1: Percentage of other healthcare professionals mentioned in the musculoskeletal modules

Table III: Universities and the healthcare professionals mentioned in the musculoskeletal conditions' modules

	UNI-1	UNI-2	UNI-3	UNI-4	UNI-5	UNI-6	UNI-7	UNI-8	UNI-9	Number and percentage (%)
Physiotherapists	-	✓	✓	✓	✓	✓	✓	✓	✓	8/9 (88.8%)
Dieticians	-	-	✓	-	-	-	-	-	-	1/9 (11.1%)
Biokineticists	-	-	✓	-	-	-	-	-	-	1/9 (11.1%)
Medical doctors	✓	✓	✓	✓	✓	-	✓	✓	✓	8/9 (88.8%)
Chiropractors	-	-	✓	-	-	-	-	-	-	1/9 (11.1%)
Occupational therapists	-	✓	✓	✓	✓	✓	✓	✓	✓	8/9 (88.8%)
Podiatrists	✓	-	-	✓	-	-	-	-	-	2/9 (22.2%)
Acupuncturists	✓	-	-	✓	-	✓	-	-	-	3/9 (33.3%)
Nurses	-	✓	-	-	-	-	-	-	-	1/9 (11.1%)

Table IV illustrates a direct comparison of the number of musculoskeletal conditions included and the healthcare professionals mentioned in each university's syllabus. UNI-3 covered 15 conditions and mentioned 6 healthcare professionals, followed by UNI-4, which covered 12 conditions and mentioned 5 healthcare professionals. The average number of musculoskeletal conditions across the nine universities was 10.3, while the mean number of healthcare professionals mentioned was 3.7.

All nine universities (100%) explicitly mentioned the role of a pharmacist in the management of musculoskeletal conditions, while only one university (UNI-3) mentioned the integration of pharmacists into the multidisciplinary team for the management of these conditions.

Table IV: Coverage of musculoskeletal conditions and healthcare professionals in BPharm curricula by universities

University	Musculoskeletal conditions (n)	Healthcare professionals mentioned (n)
UNI-1	12	3
UNI-2	7	4
UNI-3	15	6
UNI-4	12	5
UNI-5	11	3
UNI-6	9	3
UNI-7	10	3
UNI-8	8	3
UNI-9	9	3
Descriptive statistics:		
Mean (μ)	10.3	3.7
Standard deviation (σ)	2.4	1.1
Minimum	7	3
Maximum	15	6
Median (50th percentile)	10	3

Discussion

The study evaluated the syllabi of nine South African universities that offer the Bachelor of Pharmacy degree. The purpose was to investigate the musculoskeletal conditions addressed in the modules, the non-pharmacological treatment of these conditions, the inclusion of other healthcare professionals who manage these conditions, the integration of pharmacists into multidisciplinary healthcare teams, and the potential role of pharmacists in enhancing patient outcomes for

those affected by musculoskeletal conditions through appropriate and timely referrals.

The modules on pharmaceutical care/clinical pharmacy and pharmacy practice were evaluated. These modules aimed to provide students with a comprehensive understanding of the pathophysiology, presentation of the conditions, pharmacological management, and other treatment options for musculoskeletal conditions commonly encountered in pharmacy practice. Although there were variations in the conditions covered, certain conditions were consistently addressed. Notably, gout, osteoarthritis, rheumatoid arthritis, osteoporosis, trauma, and sports-related injuries were among the most common. These conditions are those most prevalent, as noted with findings of studies that have found osteoarthritis, rheumatoid arthritis, gout, fractures, back and neck pain to be prevalent musculoskeletal conditions (Briggs *et al.*, 2018; Lewis *et al.*, 2019). However, the growing prevalence of autoimmune diseases, several of which are associated with the musculoskeletal system, has prompted an urgent call to action for healthcare professionals to receive education on these diseases (Miller, 2023). Thus, inclusion of these conditions is advocated in pharmacy syllabi.

The study found that calcaneal spur, systemic lupus erythematosus, osteomalacia, osteomyelitis, and psoriatic arthritis were less commonly mentioned among the different universities. This does not mean that these conditions are not taught at the university; rather, it is possible that they are covered in another module that was not included in the evaluated modules, and/or not specifically listed. For example, conditions such as osteomyelitis, could be included in the module on infectious diseases, systemic lupus erythematosus, rheumatoid arthritis, ankylosing spondylitis, and psoriatic arthritis could be included in the module on autoimmune disorders.

This study also reports on the management of these musculoskeletal conditions. All nine universities addressed non-pharmacological management of these conditions, and the use of topical, and/or CAM. This is significant as the pharmacist's role extends beyond western medicine to include other potentially beneficial treatments for patients (Harnett & Ung, 2023). CAM approaches, such as aromatherapy, hydrotherapy, hypnosis, acupuncture, or chiropractic care, may also be considered as non-pharmacological treatment options for musculoskeletal conditions (Sharma *et al.*, 2022). However, there are studies which have reported that pharmacists have concerns over the safety and efficacy of CAMS (Clayton *et al.*, 2023). Thus, the scientific evidence needs to be consulted before making recommendations on CAM use.

The non-pharmacological management included educating patients on the importance of regular exercise, low-impact activities such as swimming or cycling, to improve strength and flexibility, weight management, and the use of assistive devices such as braces. This is supported by a study that suggested prioritising non-pharmacological management in primary care to alleviate musculoskeletal pain (Kligler *et al.*, 2018). By emphasising non-pharmacological approaches, pharmacists can empower patients to take an active role in managing their musculoskeletal health, promoting overall well-being, and reducing the burden of these conditions (Harnett & Ung, 2023; Engelbrecht *et al.*, 2024).

The management of musculoskeletal disorders requires a holistic approach that incorporates multiple scientific disciplines, inclusive of healthcare professionals, such as pharmacists, medical doctors, biokineticists, physiotherapists, occupational therapists, etc., to develop comprehensive and individualised treatment plans for patients (Takahashi *et al.*, 2019; Shapovalov *et al.*, 2023). This approach requires 'collaborative practice-ready' graduates, since students not exposed to interprofessional education as undergraduate students are less inclined to engage in collaborative practice post-graduation (El-Awaisi *et al.*, 2018; Engelbrecht *et al.*, 2024). All universities reported the involvement of other healthcare professionals in managing musculoskeletal conditions, most frequently physiotherapists, medical doctors, and occupational therapists.

It is noteworthy that there are universities which did not mention these healthcare professionals in their teaching material, such as lecture slides, tutorials, etc.; however, these healthcare professionals were included in the recommended references for students. International studies have highlighted the need for a multidisciplinary team inclusive of medical doctors, nurses, psychiatrists, psychologists, physiotherapists, pharmacists, and dieticians (Takahashi *et al.*, 2019; Lamper *et al.*, 2021; Shapovalov *et al.*, 2023). Care for patients with musculoskeletal conditions is currently organised in "silos" rather than using an integrated approach, resulting in fragmented patient care (Takahashi *et al.*, 2019; Lamper *et al.*, 2021).

Dietitians, biokineticists, nurses, and chiropractors accounted for the lowest percentage of healthcare professionals mentioned in the musculoskeletal modules. This might mean that some graduates may be unfamiliar with the role that these healthcare professionals play in the management of these conditions and therefore less referrals from pharmacists. Effective management of patients with musculoskeletal conditions involves a diverse healthcare team consisting

of medical doctors and other professionals who specialise in addressing both the physical and psychological aspects of pain (Shapovalov *et al.*, 2023).

The study acknowledges that certain healthcare professionals may be referenced in other modules. For example, dietitians may only be mentioned in modules related to gastrointestinal conditions, cardiovascular diseases, or nutrition, while psychiatrists/psychologists may be mentioned in the central nervous system module. However, it is important that the relevant healthcare professionals be included in the musculoskeletal conditions modules so that students are able to link the healthcare professional and the musculoskeletal condition. For the majority of students, integrative learning may not be spontaneous; thus, it has to be consciously fostered (Pearson & Hubball, 2012; El-Awaisi *et al.*, 2018). The purpose of an integrated module is to establish horizontal linkages between different disciplines and vertical connections between theoretical knowledge and practical application (Pearson & Hubball, 2012; Kerr *et al.*, 2020). This may assist the graduate in referring the correct patients to the correct healthcare professional.

Only one university described the scope, roles, and responsibilities which other healthcare professionals play in the management of musculoskeletal conditions. The reason for this inclusion remains unclear. Other universities may prioritise pharmacist-specific content, leaving limited space in the syllabi for a detailed coverage of the roles of other healthcare professionals, or they may lack support from other departments or faculties. Alternatively, the university in question might have gone beyond the minimum standard or aligned with international best practices. Since SAPC accreditation does not mandate detailed interprofessional content, there may be little incentive for others to include it (Mosiane *et al.*, 2022; SAPC: Bachelor of Pharmacy Curriculum Outline and Criteria for Accreditation, 2024).

Educating pharmacy students on the role of other healthcare professionals is paramount (El-Awaisi *et al.*, 2018). The absence of a description of the role of other healthcare professionals implies that students will continue in their uni-professional education, through antiquated static syllabi, which ultimately moulds graduates who are inadequately prepared, work in silos, provide fragmented patient care, and are susceptible to the influence of healthcare professional tribalism and hierarchical structures (El-Awaisi *et al.*, 2018). Educators need to ensure that their syllabi equip graduates with the necessary skills to establish mutual trust and respect with other healthcare professionals (Saragih *et al.*, 2024). Pharmacists must understand and appreciate the responsibilities and contributions of their fellow healthcare professionals in order to effectively collaborate and provide comprehensive patient care (Safo *et al.*, 2022; Crafford *et al.*, 2023).

The study further reported that, on average, universities included approximately ten musculoskeletal conditions and referenced around four healthcare professionals in their pharmacy curricula. Notably, UNI-3 demonstrated the most comprehensive coverage, addressing 15 musculoskeletal conditions and referencing six healthcare professionals, which may indicate a robust and well-integrated curriculum that effectively supports interprofessional education. In contrast, most universities mentioned between three and four healthcare professionals, regardless of the number of musculoskeletal conditions covered. This suggests that even when musculoskeletal content is comprehensive, collaboration among healthcare professionals is not always equally emphasised. These findings highlight a potential disconnect between the depth of clinical content and the level of preparation students receive for collaborative practice (El-Awaisi *et al.*, 2018; Engelbrecht *et al.*, 2024).

Although it is natural for variation to exist between university syllabi, the authors of this paper, based on the findings, question the extent of such autonomy. Pharmacists are required to possess a comprehensive understanding of disease states that enables critical thinking, clinical decision making and appropriate referral practices. Yet, the pharmacy student should not be overwhelmed with excessive content, as this may hinder effective learning. It is difficult to identify a balance, and the findings of the study highlighted that variation, leading to a new question: what should be consistently included in the BPharm syllabus and what should be considered supplementary? This question extends beyond musculoskeletal conditions, but could be extended to topics such as paediatrics, respiratory diseases, mental health disorders, etc. It may be worthwhile to consider the development of entrustable professional knowledge on certain topics. These would be an approved list where research is undertaken to identify what diseases or issues should be included within a topic, ensuring all the topics are, in fact, relevant and reflect societal needs and current expectations of pharmacists.

All universities explicitly addressed the pharmacist's role in managing musculoskeletal conditions, likely because these conditions often present with pain and/or inflammation, which pharmacists commonly manage with over-the-counter (OTC) medications. Pharmacists are known for their expertise in pharmacology knowledge; they play a crucial role in educating patients on the correct use of medication, possible side effects, correct administration and dosing,

and patients' understanding of their medical condition and symptoms, the dangers of analgesic abuse and misuse, as well as the importance of safe storage and proper disposal of unused medications (Perrot *et al.*, 2019; Gregory & Gregory, 2020). Pharmacists serve as primary access points to primary health care and provide preventative and public health services (Udoh *et al.*, 2020), thus their role could be expanded beyond a narrow perspective of dispensing and advise on the use of the medication.

Community pharmacists are integrated into primary healthcare programmes in developed countries such as Australia, Canada, and the United Kingdom, whereas in developing countries such as Ethiopia and other sub-Saharan African countries, pharmacists' roles are largely limited to dispensing (Ayele *et al.*, 2018; Udoh *et al.*, 2020). South Africa is not immune to the lack of integration of primary healthcare services provided by pharmacists. A study conducted in the Eastern Cape Province of South Africa revealed that pharmacists spend more time on administrative activities and have limited time for patient care functions. As a result, there is a missed opportunity to enhance patient care through collaboration with other healthcare professionals (Bobbins *et al.*, 2020). In addition, pharmacists lack a formal, remunerated referral system, which might potentially hinder their ability to collaborate with other healthcare providers (Sim *et al.*, 2020).

Based on the study, the following recommendations are proposed to improve the training of pharmacy students in managing musculoskeletal conditions, enhance patient care, and promote collaborative-ready graduates:

- Module Integration: conditions that affect multiple systems may be cross-referenced among various modules. For examples, osteomyelitis can be included in both infectious disease and musculoskeletal conditions modules, and systemic lupus erythematosus can be included in both autoimmune disease and musculoskeletal conditions modules.
- Integrate Collaborative Learning: The roles and responsibilities of other healthcare professionals involved in musculoskeletal care, such as physiotherapists, dietitians, biokineticists, occupational therapists, psychiatrists, and psychologists, should be explicitly detailed in lessons, lecture slides, tutorials, and/or other educational materials. Encouraging interdisciplinary education fosters a culture of teamwork, thereby enabling students to confidently link specific conditions to the appropriate professionals for referral, and collaboration post-graduation.
- Foster Collaborative Practice: Establish "collaborative practice-ready" graduates by ensuring that all students are exposed to interprofessional education during their undergraduate years. This may include joint learning sessions with students from other health disciplines, using case-based learning and simulations involving multidisciplinary teams to enhance students' understanding of communication, referral and collaboration with healthcare professionals in real-world settings.
- Accreditation bodies such as the South African Pharmacy Council and the Council on Higher Education can use these insights to refine accreditation criteria, encouraging more explicit inclusion of interdisciplinary training and non-pharmacological content in pharmacy curricula for all modules.
- The approach used in the study can be replicated in other health professions (e.g., physiotherapy, occupational therapy, biokineticists) to evaluate their curricula's readiness for collaborative practice in managing chronic conditions, as well as seeking support from other faculties, schools or departments within the university to initiate stronger collaboration.
- Entrustable professional knowledge could be a new area of research to assist in defining themes that should be included in a syllabus.

The universities need to be cognisant of potential implementation challenges associated with these recommendations. These challenges may include the pre-existing content-heavy curriculum and the difficulty of integrating additional material on interprofessional roles and non-pharmacological treatments due to limited instructional time and competing academic priorities. Furthermore, the lack of support from other health disciplines may further impede the incorporation of interdisciplinary training components into pharmacy modules.

Limitations

This study relied on curriculum documents and teaching materials from universities, which may not capture all content delivered in lectures, work-based learning, or informal settings. Inconsistencies in module structure and presentation can affect the study's conclusions. The focus on musculoskeletal modules excludes relevant content on interprofessional collaboration or healthcare roles, which may be found elsewhere in the syllabi. The qualitative nature means findings are descriptive and cannot establish causality. Including all nine accredited pharmacy schools in South Africa enhances generalisability, but variability in curriculum delivery and updates may influence results. The absence of input from students, lecturers, or practising

pharmacists limits evaluation of curriculum perception and implementation.

Conclusion

Musculoskeletal conditions are a significant health issue in South Africa and globally, causing pain, disability, and reduced quality of life for individuals. The most common conditions in the South African BPharm modules were gout, osteoarthritis, rheumatoid arthritis, osteoporosis, trauma, and sports-related injuries. All nine universities addressed the non-pharmacological management of these conditions, which requires a comprehensive approach that incorporates multiple scientific disciplines. This highlights the need for pharmacists to collaborate with other healthcare professionals. The most commonly mentioned healthcare professionals were physiotherapists, medical doctors, and occupational therapists. It is important that pharmacy students are exposed to interprofessional education as undergraduate students, as they will be more inclined to engage in collaborative practice after graduation. Only one university clarified the roles of other healthcare professionals. Therefore, the description of the roles of other healthcare professionals needs to be integrated into the modules so that students are able to make a direct association between the healthcare professional and the musculoskeletal condition. This approach can be applied in other educational contexts to enhance interdisciplinary understanding and prepare graduates across health professions for collaborative practice in managing all conditions. This will allow pharmacists to understand the full scope of patient care and make appropriate treatment recommendations and referrals.

Conflict of interest

The authors declare no conflict of interest.

Source of funding

The authors did not receive any funding.

Ethics approval and informed consent

The study was approved by the University of Witwatersrand Human Research Ethics Committee (Medical) clearance certificate number: M220344, Nelson Mandela University Research Ethics Committee (Human) reference number: H23-HEA-PHA-EAP-001, North-West University Health Research Ethics Committee – Ethics number: NWU-00165-23-S1 and University of Limpopo – Turfloop Research Ethics Committee reference number: TREC/55/2024. Permission from gatekeepers was received from Rhodes University, Sefako Makgatho Health Sciences University, Tshwane University of Technology, University of KwaZulu-Natal and University of the Western Cape.

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