



Faculty Survey on the Status of Lymphology Education in Professional Doctor of Physical Therapy Programs

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Background and Purpose: The lymphatic system is vital for fluid homeostasis, waste removal, immunity, and tissue healing. It can be impacted by multiple diseases and traumatic processes seen by physical therapists across practice settings; hence, lymphology education in professional (entry-level) doctor of physical therapy (DPT) programs is needed. Studies to obtain information about professional DPT lymphology education have not been conducted for 20 years. The purposes of this study were to (1) describe current, typical lymphology content within professional DPT programs; and (2) identify whether lymphology content is perceived as entry-level material amongst professional DPT faculty who were responsible for teaching lymphology content (TL) and professional DPT faculty who did not teach lymphology content (NLT). **Subjects:** Professional DPT faculty (N = 43) in the United States who taught or did not teach lymphology curriculum. **Methods:** Cross-sectional online survey research design. Descriptive data were gathered on lymphology content, hours, and curriculum standings. The χ^2 test assessed relationships between faculty status and entry-level lymphology curriculum status. The Spearman rank correlation coefficient assessed relationships between teaching hours and entry-level status. **Results:** Variability exists across curricula in range of hours devoted to didactic (0.4-14.1 hours) and laboratory (0-10 hours) instruction pertaining to lymphology. Individual curriculum contents were predominantly considered entry-level material. **Limitations:** Response rate was limited. **Conclusion:** Consistent lymphology curriculum content and format are lacking within the professional DPT programs that participated in the survey, indicating opportunities for advancements in entry-level lymphology education and investigation into best educational practices for teaching this content. (*Rehab Oncol* 2020;000:1-9) **Key words:** content, entry-level, format

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Lymphology is the study of the lymphatic system, including its anatomy, physiology, and pathology.¹ The lymphatic system is part of the immune system and the circulatory system but stands independently as a unique system of the body.^{2,3} The lymphatic system transports lymphatic loads (ie, water, protein, long-chain fatty acids, hyaluronan, and cell fragments) to the venous system.^{2,4-6} As a vital component of microcirculation, the lymphatic system maintains fluid homeostasis and is responsible for the management of edema.^{3,7} In 2018, the blueprint of the National Physical Therapy Examination (NPTE) changed by partitioning the lymphatic system from the cardiovascular and pulmonary systems as a separate body system, essential for clinical application of knowledge required of

professional physical therapy (PT) practitioners.^{8,9} Knowledge of the fundamentals of lymphology is important for physical therapists to provide safe and effective care to patients with various causes and classifications of edema.

The most recent survey research on lymphedema management content in PT programs was conducted in 1998. The authors reported that designated curricular content about lymphatics (89%) and lymphedema (73%) was being taught in PT programs, but that far less content on the specifics of anatomy and physiology (42%) and innovative treatment techniques (48%) was included.¹⁰ Currently, there is a need to have a more contemporary understanding of what is being taught in professional (entry-level) doctor of physical therapy (DPT) lymphology curricula.

The professional DPT curriculum content includes clinical sciences pertaining to the major systems of the body.¹¹ These systems include the cardiovascular, metabolic, gastrointestinal, endocrine, integumentary, musculoskeletal, neurological, genital and reproductive, renal and urologic, pulmonary, and lymphatic systems.^{11(p26,7C)} To prepare professional DPT graduates in becoming effective clinical and scholarly practitioners, the Commission on Accreditation in Physical Therapy Education (CAPTE) mandates that there should be content and learning experiences related to these systems, coupled with “system interactions, differential diagnosis, and the medical and surgical conditions across the lifespan commonly seen in physical therapy practice.”^{11(p26,7C)} CAPTE requires that lymphology curriculum content should include examination, evaluation, diagnosis, and interventions of circulation (arterial, venous, lymphatic) and integumentary integrity.^{11(pp28-29,7D19,7D27)} In the Guide for Physical Therapist Practice 3.0, the APTA describes skill sets that are a part of professional PT practices including examination, evaluation, and selection of interventions pertaining to the lymphatic system.¹² Examination and reexamination of the peripheral circulation, including lymphedema, are considered minimum required skill sets per the APTA Board of Directors (BOD).¹³ According to the APTA Section of Women’s Health, professional physical therapist graduates addressing the integumentary system should have a mastery level of lymphatic anatomy, a proficiency level of lymphatic physiology, and a familiar level of lymphatic pathophysiology and management.¹⁴

The 2018 NPTE content outline, provided by the Federation of State Boards of Physical Therapy (FSBPT), indicates that the lymphatic system comprises up to 8 test items out of a possible 191 body system items pertaining to examination, intervention, and foundations for evaluation, differential diagnosis, and prognosis.^{8,9} The NPTE content outline informs faculty and students of the importance of “movement analysis as related to the lymphatic system,” and the “interpretation of knowledge about diseases/conditions of the lymphatic system.”⁸ The examination blueprint descriptions of the NPTE include the importance of entry-level knowledge of adverse effects or complica-

tions on the lymphatic system, as a result of physical interventions upon the lymphatic system or other systems.⁸ Lymphedema affects one in every 1000 Americans,¹⁵ and while lymphology is not a large portion of the body system items on the NPTE, the incidence of varied clinical presentations in PT appears to substantiate its curricular distinction.

Physical therapists provide interventions for limitations in movement, and the pain that may occur from inflammatory processes or various profiles of edema (ie, effusion, pitting edema), while being guided by the chronological characterizations of tissue healing (eg, acute, subacute, and chronic).^{16,17} Professional DPT students should be knowledgeable about different edematous diseases, chronological edema modifications, and lymphatic classifications (ie, dynamic insufficiency, mechanical insufficiency, combined insufficiency) in order to make appropriate differential diagnoses. This foundational knowledge would be considered an important component of a physical therapist’s clinical reasoning^{18,19} for proper edema treatment and rehabilitation choices (eg, ice, elevation, manual lymph drainage, compression, exercise). In addition, best evidence PT interventions for the lymphatic system are to be understood under the premise of anatomy and physiology for rehabilitation, health promotion, and physical performance.⁹ Preparing professional DPT students for clinical reasoning strategies should include evidenced-based, entry-level skill sets for the intervention of various kinds of edema within the various stages of healing, which might consist of manual lymphatic techniques and compression bandaging.²⁰⁻²⁶ Providing best practice treatment methods for the type of edema and prevailing physiological conditions has been reported to be safe and effective and improves quality-of-life outcomes.²⁷⁻²⁹

According to Sander and Perdomo,³⁰ there has been a lack of literature investigating curriculum models that integrate management into the professional DPT curriculum. These authors investigated 2 models developed to integrate edema management into the professional PT curriculum. According to Sander and Perdomo,³⁰ the Northwestern University Department of Physical Therapy and Human Movement Science (DPTHMS) and the University of Southern California (USC) have demonstrated higher rankings than other programs on the FSBPT examination in the areas of cardiovascular and pulmonary systems and the lymphatic system. The Northwestern University DPTHMS administers a separate 40-hour course combining lymphatic and integumentary dysfunctions, 20 of which are spent in examination and intervention skills for edema/lymphedema. USC administers 29 hours in edema management integrated throughout several courses in the program’s 3-year curriculum. In both curriculum styles, didactic anatomy, physiology, and pathology information is enhanced through training in skill sets pertaining to examination and intervention (including manual lymph drainage and short-stretch compression bandaging) that required approximately 10 to 13 class hours.³⁰ While this case study outlines distinguishable perspectives on content

and instructional guidelines for edema and lymphedema management, there exist gaps of what content is currently taught or expected to be taught, who teaches the content, and across which disciplines.

The purposes of this study were to (1) describe the current lymphology content within professional DPT programs and (2) identify whether lymphology content is perceived as entry-level material amongst professional DPT faculty who were responsible for teaching lymphology content (TL) and professional DPT faculty who did not teach lymphology content (NTL).

METHODS

E-mail addresses of program directors from accredited professional DPT programs in the United States were retrieved from the CAPTE Web site. Survey links were e-mailed to program directors of 221 professional DPT programs (October 2017-December 2017), who, in turn, were requested to disseminate the survey link through e-mail to all of their faculty members. Two follow-up e-mails were disseminated during this time interval. Survey responses were separated into 2 groups: TL and NTL. The inclusion of NTL subjects was determined to offer nonbiased interdisciplinary opinions about entry-level curriculum content status on lymphology, whose physiological effect crosses disciplines in professional DPT curricula. A total of 53 surveys were returned (24% response rate). Participants could choose to not to answer survey questions, which resulted in missing data. Ten surveys were incomplete, leaving 43 surveys with complete data sets for analysis. Thirty-five separate universities were represented. Descriptive data are presented in Table 1. The areas of acquired specialty certifications and the primary practice patterns that respondents taught were partitioned into TL and NTL respondents (Table 2).

A cross-sectional survey research design was implemented. Using a 37-item online Faculty Survey on Lymphology through Qualtrics software, version 2018 (Qualtrics, LLC, Provo, Utah) (see Appendix A, Supplemental Digital Content 1, available at: <http://links.lww.com/REHABONC/A21>), information was gathered about the current status of lymphology education in the respondent's professional DPT program and overall curriculum content in programs in the US education. Questions concerning the characteristics of the survey respondents and professional DPT lymphology curriculum content, format, and hours of instruction were included in the survey. Face validity of the survey was attested by the primary investigator and a collaborative colleague via its design based on similar studies.^{10,31} Consultation with colleagues in the field of survey research (n = 3), lymphology (n = 4), and generalist (n = 2) resulted in questionnaire modifications. An agreement amongst these colleagues (n = 6) on the final survey instrument conferred content validity of the survey instrument. The questionnaire was pilot tested by 4 professional DPT faculty members, 2 of which had teaching experience in lymphology, as well as 2 certified lymphedema

TABLE 1
Characteristics of Faculty Survey Respondents

	n (%)
Age (N = 42 ^a), y	
31-40	3 (7.0)
41-50	18 (41.9)
51-60	12 (27.9)
61 or older	9 (20.9)
Gender (N = 42 ^a)	
Female	32 (74.5)
Male	9 (20.9)
Preferred not to answer	1 (2.3)
Location of teaching institution (N = 43)	
West	8 (18.6)
Midwest	14 (32.6)
South	12 (27.9)
Northeast	9 (20.9)
Type of teaching institution (N = 42 ^a)	
Private	17 (39.5)
Public	25 (58.2)
Employment status (N = 42 ^a)	
Full-time	40 (93.1)
Part-time	1 (2.3)
Occasional	1 (2.3)
Job position ^b	
Adjunct/liaison	3 (7.0)
Assistant professor	14 (32.6)
Associate professor	15 (34.9)
Clinical professor/director	3 (7.0)
Curriculum coordinator	2 (4.7)
Director of professional DPT program	6 (14.0)
Professor	7 (16.3)
Other	3 (7.0)
Currently in clinical practice (N = 43)	
Yes	30 (69.8)
No	13 (30.2)

^aOne survey did not complete demographic information (2.3%).

^bRespondents may have more than 1 job position.

therapists. Feedback on the pilot testing promoted modifications to the final survey. The study was approved by the Health Sciences and Behavioral Sciences Institutional Review Board of the University of Michigan-Flint.

Data were analyzed using SPSS version 24 (Armonk, New York). Descriptive statistics are presented as means ± standard deviations, frequencies (%), and, where appropriate, interquartile ranges. The χ^2 test of independence was used to determine whether there were significant relationships between faculty status (TL and NTL) and perceptions on entry-level status of curriculum topics. Across all analyses, the α level of significance was set at .05.

RESULTS

Information collected on content taught on lymphology within professional DPT programs was obtained from TL. Ninety-two percent (n = 35) of respondents reported that lymphatics anatomy and physiology was taught at their professional DPT program. Lymphatics anatomy and physiology was taught in 4 courses, including anatomy (52.6%; n = 20), integumentary (47.4%; n = 18), pathophysiology (44.7%; n = 17), and cardiopulmonary

TABLE 2

Characteristics of Respondents Responsible and Not Responsible for Teaching Lymphatic Content With in a Professional DPT Program

Faculty Teaching Lymphatic Content ^a	(N = 38)	Faculty Not Teaching Lymphatic Content ^a	(N = 5)
Specialty	n (%)	Specialty	n (%)
Cardiovascular and pulmonary	5 (13.2)	None	3 (60)
Lymphedema	16 (42.1)	Orthopedics	1 (20)
Women's health	2 (5.3)	Neurology	1 (20)
Wound care	6 (13.5)		
None	4 (10.5)		
Orthopedics	6 (15.8)		
Geriatrics	4 (10.5)		
Neurology	2 (5.3)		
Other	3 (7.9)		
Primary Area of Practice of Faculty Teaching Lymphatic Content^a	n (%)	Primary Area of Practice of Faculty Not Teaching Lymphatic Content^a	n (%)
Cardiovascular/pulmonary	13 (34.2)	Cardiovascular/pulmonary	1 (20)
Integumentary	22 (57.9)	Musculoskeletal	2 (40)
Musculoskeletal	12 (31.6)	Neuromuscular	3 (60)
Neuromuscular	10 (26.3)	Geriatrics	1 (20)
Pediatrics	3 (7.9)	Other	1 (20)
Women's health	5 (13.2)		
Geriatrics	8 (21.1)		
Other	10 (26.3)		

Abbreviation: DPT, doctor of physical therapy.

^aRespondents were allowed to choose more than 1 option.

(34.2%; n = 13). Ninety-two percent (n = 35) of respondents reported that their programs taught lymphatic pathophysiology and that it was taught in one of 3 courses including integumentary (44.7%; n = 17), pathophysiology (47.4%; n = 18), and cardiopulmonary (26.3%; n = 10). Table 3 presents the descriptive data related to the hours spent teaching anatomy, physiology, and pathophysiology of the lymphatic system, as well as lecture hours and laboratory hours taught on examination. Types of edema most frequently taught were mechanical insufficiency (86.8%; n = 33), dynamic insufficiency (73.7%; n = 28), combined insufficiency (68.4%; n = 26), and lipedema (57.9%; n = 22), whereas chronic venous insufficiency (CVI) was less frequently taught (39.5%; n = 15). Ninety percent (n = 34) of respondents reported that their professional DPT programs taught on examination pertaining to lymphatics. Examination including circumferential measurements, special tests, volumetric measurement, and integument was taught in the integumentary course (44.7%; n = 17), followed by cardiopulmonary (28.9%; n = 11) and musculoskeletal (21.1%; n = 8), whereas an assortment of other courses (39.5%; n = 15) were also men-

tioned. Ninety-five percent (n = 36) of the TL respondents reported teaching interventions pertaining to lymphology in the integumentary (47.4%; n = 18) and cardiopulmonary (31.6%; n = 12) courses, whereas other courses (34.2%; n = 13) were also stated. Types and frequency of interventions taught included compression devices (84.2%; n = 32), multilayer compression bandaging (78.9%; n = 30), skin care (78.9%; n = 30), therapeutic exercises (78.9%; n = 30), manual lymphatic techniques (68.4%; n = 26), and sequential compression pumps (65.8%; n = 25). Table 4 presents the descriptive data on the hours spent teaching various interventions related to the topic of lymphology.

Respondents somewhat agreed to strongly agreed that the subject matters of anatomy and physiology (88.4%; n = 38), pathophysiology (90.7%; n = 39) of the lymphatic system, and examination of the lymphatic system (81.4%; n = 35) were entry-level material. Figure 1 presents frequencies of additional specific didactic content that was further analyzed for entry-level content. Opinions from all respondents (TL and NTL) regarding whether interventions should be included in professional

TABLE 3

Hours of Lecture and Laboratory Education Devoted to Anatomy and Physiology, Pathophysiology, and Examination

	Anatomy and Physiology Lecture Hours (n = 33)	Pathophysiology Lecture Hours (n = 34)	Lecture Hours Examination (n = 29)	Laboratory Hours Examination (n = 25)
Mean	2.8	2.5	1.6	2.0
Median	2.0	1.7	1.0	1.0
SD	2.8	2.7	1.4	2.1
Minimum	0.5	0.4	0.5	0.5
Maximum	14.0	14.1	6.1	8.1

TABLE 4

Descriptive Data on Hours of Lecture and Laboratory Professional DPT Education for Lymphatic Interventions

Curriculum Content	Mean	Median	SD	Minimum	Maximum
Compression devices					
Lecture hours (n = 31)	0.73	0.50	0.75	0.10	2.70
Laboratory hours (n = 25)	0.99	0.50	1.33	0.00	6.10
Manual lymph drainage					
Lecture hours (n = 31)	1.03	0.70	1.01	0.00	3.20
Laboratory hours (n = 28)	1.95	1.00	2.19	0.00	8.00
Compression bandaging					
Lecture hours (n = 31)	0.68	0.50	0.63	0.10	2.80
Laboratory hours (n = 30)	1.38	1.00	1.34	0.00	6.40
Sequential pneumatic pump					
Lecture hours (n = 28)	0.56	0.30	0.64	0.10	2.70
Laboratory hours (n = 21)	0.79	0.40	0.99	0.00	4.00
Skin care					
Lecture hours (n = 29)	0.88	0.50	1.14	0.10	4.00
Laboratory hours (n = 23)	1.13	0.50	1.68	0.00	8.00
Therapeutic exercise					
Lecture hours (n = 29)	1.16	0.60	1.33	0.10	5.00
Laboratory hours (n = 25)	1.50	0.50	2.11	0.00	10.00

Abbreviation: DPT, doctor of physical therapy.

DPT programs varied. Pertaining to didactic education of manual lymphatic techniques and multilayer compression bandaging, 58.1% (n = 25) and 58.1% (n = 25), respectively, of the respondents somewhat agreed to strongly agreed that the content material was entry level. More specific intervention frequencies are presented in Figure 2. Perceptions about the entry-level status of discrete curriculum topics (eg, anatomy, pathophysiology, examinations, compression bandaging, and manual lymph

drainage) were not significantly different between TL and NTL.

Respondents similarly reported 4 main challenges in integrating lymphology into professional DPT programs, those being lack of time (62.8%; n = 27), lack of expertise (44.2%; n = 19), content undervalued by students (37.2%; n = 16), and content undervalued by faculty (37.2%; n = 16). Thirty percent (n = 13) of the respondents also reported that lymphology material was beyond

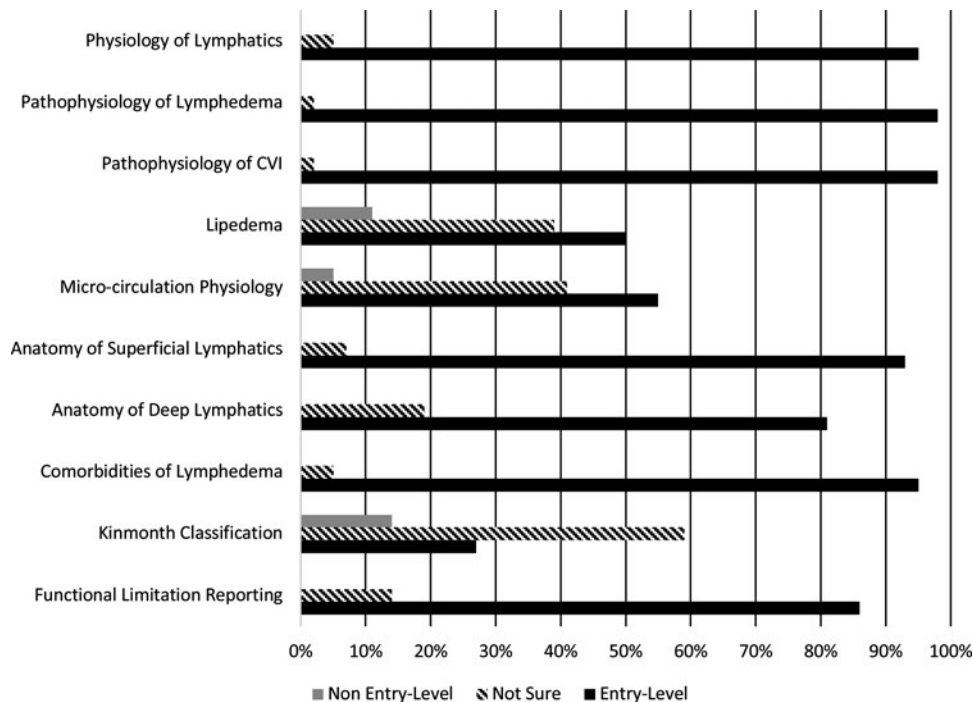


Fig. 1. Frequency of respondents (N = 43) rating didactic material as non-entry-level, not sure, and entry-level. CVI indicates chronic venous insufficiency.

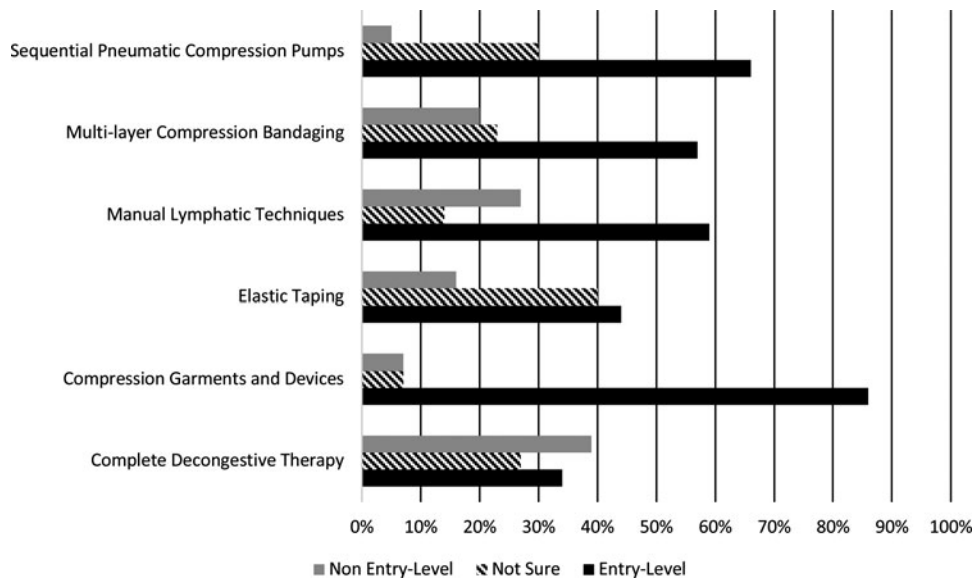


Fig. 2. Frequency of respondents (N = 43) rating intervention material as non–entry-level, not sure, and entry-level.

entry-level knowledge. Observed strategies to integrate the subject matter of lymphatics into professional DPT programs included (1) consultation with credentialed therapist(s) about the subject matter (65.1%; n = 28), (2) credentialed liaison/adjunct instructor to teach the subject (60.5%; n = 26), and (3) offered supervised clinical education experiences with either lymphedema clinics or clinics that have a certified lymphedema therapist (32.6%; n = 14).

DISCUSSION AND CONCLUSIONS

Survey results from this study identified current lymphology content within professional DPT programs and indicate that programs most frequently teach on lymphology intervention, followed by anatomy, physiology, and pathophysiology, and, to a lesser extent, examination content. Peripheral circulation examination and reexamination (including lymphedema) are considered a minimum required skill set by the APTA BOD.¹³ CAPTE¹¹ emphasizes the knowledge base of examination, evaluation, and diagnosis of the lymphatics, whereas the NPTE⁸ may include topics related to examination, differential diagnosis, prognosis, and interventions. Lymphology content is taught mostly in the integumentary course, followed by pathophysiology and cardiopulmonary courses. While lymphatics are present in the integumentary system and most tissues of the body, its independent significance is evident and recognized by the FSBPT.⁹ Additional lymphology content within the respondent's professional DPT programs focused on teaching about mechanical insufficiency of the lymphatic system but less about dynamic insufficiency and combined insufficiency. Lipedema and CVI that involve lymphatic insufficiency classifications were taught in only a few programs.

The current study offers evidence that there has been an increase (76.3%) in curricular content devoted to contemporary intervention techniques (manual lymph drainage, skin care, exercise, and compression bandaging) since the survey results (48%) from 1998. As this study reports, the frequency of teaching about compression devices (garments and bandage alternatives) took precedence to other interventions. These compression devices are typically considered for patient use in self-management, rather than a source of intervention during the more intensive decongestive PT treatments.

Survey results from this study identified entry-level status of lymphology content within professional DPT programs. Across most didactic lymphology curriculum topics, respondents have a unified perception of what constitutes entry-level lymphology material (Figure 1). Those topics that varied in opinion lend more to uncertainty than to non–entry-level status. Respondents in this survey labeled most of the didactic curriculum as being entry-level including anatomy (suprafascial and subfascial), physiology, and lymphedema pathophysiology (including its comorbidities). Lipedema and microcirculation were considered entry-level; albeit, the frequency taught was less than other topics. Pathophysiology of CVI was considered entry-level; however, not all programs taught CVI content. A majority of respondents perceived that didactic education on Kinmonth classifications¹⁵ of primary lymphedema was either not entry-level material or unsure of the entry-level status. For the purposes of clinical reasoning and differential diagnosis, understanding various diseases of the lymphatic system and having the skill sets of lymphatic examination, evaluation, and diagnosis would align with their importance as indicated by CAPTE¹¹ and the APTA BOD.¹³ Professional DPT students may benefit from the knowledge of Kinmonth primary lymphedema classifications since it provides a framework for differential

diagnoses and clinical reasoning for proper intervention or referral. For example, in the case of adolescent onset primary lymphedema (ie, praecox), the manifested edema is often attributed to other causes (eg, trauma) and dismissed by professionals,³² which may lead to advancement of the disease without proper intervention or referral.

This survey provided evidence that respondents varied in opinion as to whether the intervention of complete decongestive therapy (CDT) was entry-level education but trended toward non-entry-level status. However, individual components of CDT (ie, manual lymphatic techniques, compression bandaging, compression garments) trended toward entry-level status (Figure 2). Compression garment and device interventions were largely considered entry-level content. Despite evidence for its guarded and adjunct use for the treatment of lymphedema,³³⁻³⁵ sequential pneumatic compression pumps were considered entry-level status. Consideration should be taken of where (cardiovascular vs lymphatic system) and how this education is best delivered, since sequential pneumatic compression pumps are indicated for deep vein thrombosis prevention and post-thrombotic syndrome, despite lack of dosage protocols and treatment strategies.³⁶

The extent to which professional DPT curricula are currently meeting lymphology educational requisites is determined by the individual programs. However, inconsistency of the didactic and laboratory hours is noted in this study. While it is expected that individual curricula would have variability in educational hours, the range (didactic = 0.40-14.10 hours and laboratory = 0.00-10.00 hours) is broad (Tables 3 and 4).

Similar to the cardiovascular system, the physiological importance that the lymphatic system provides to the integument, muscles, nerves, joints, periosteum, and central nervous system warrants consideration of both its placement and timetable in a curriculum. The breadth of lymphology topics indicates that lymphology curricula could extend across practice patterns, but this may prove to be a difficult task for professional DPT programs. Augustine et al¹⁰ reported that the main challenges for faculty in integrating lymphology into professional DPT programs included lack of time, expertise, and that the content was undervalued, which this current study reaffirms in reporting 4 main challenges in integrating lymphology into professional DPT programs. Sander and Perdomo³⁰ seem to echo a similar viewpoint, stating that a key to successful delivery of edema and lymphedema management material was the availability of faculty members trained in the management of lymphedema. Affording professional DPT students specialized clinical rotation opportunities with certified lymphedema clinicians may fill the gap in scenarios in which these trained faculty members are unavailable or to augment the current lymphology education.

This study had limitations in methodology and response rate. First, recruitment of faculty who were involved in the lymphology curriculum allowed for more than 1 faculty member per university to respond to the survey. This may have resulted in a duplication of quanti-

tative data for these university's curricula; however, consideration should be given that their summative individual responses may have also been an accurate representation of the curriculum. Second, FSBPT data on the NPTE scores pertaining to lymphology content are combined with cardiopulmonary scores and do not afford the ability to assess the national outcome averages pertaining to the lymphatic content alone. Third, Web-based surveys yield less response than other modes of survey delivery and, on average, yield an expected 35% response rate, or approximately a third of the surveys administered.³⁷⁻³⁹ Therefore, using a 35% response rate, we initially expected a sample size of approximately 80 representatives from a larger pool of accredited professional DPT programs in the United States, assuming that all these programs deliver a lymphology curriculum. Despite reminder e-mail notifications to the program directors to enhance participation, the response rate (24%) was marginal. Unfortunately, this low response rate and limited geographical representation would not allow us to generalize the outcomes. Regardless of the inclusivity efforts imbedded in the survey instructions and e-mail reminders, a significant disproportion of TL to NTL respondents (Table 2) occurred.

This survey investigation concerning lymphology content in professional DPT programs establishes a foundation in which future studies are warranted. To ensure safe and effective entry-level PT practice, future studies may consider investigating DPT programs that offer specialist certifications and those that offer lymphology education without certification. Interviews with individual faculty members may clarify the reasons for the variability of hours devoted to lecture and laboratory and toward anatomy, physiology, pathophysiology, examination, and intervention content. As FSBPT data emerge beyond 2018, future research may consider analyzing survey curriculum data with national outcome data. In addition, a future study may consider repeating this study in curricula of other health care professionals including physical therapist assistants and occupational therapists. Methodology of a similar survey should attempt to improve response rates of national surveys that isolate a specific field of study within a particular discipline of medicine. The opportunity for discussions about appropriate curriculum placement and content on lymphology exists across practice patterns. The International Lymphedema Framework has developed the Lymphoedema Education Benchmark Statements, which were developed as a reference and guideline to "foster global consistency and governance in relation to lymphoedema education."⁴⁰ These statements may prove to be a foundational resource for future deliberations amongst professional DPT programs to establish consistency and governance of curricula that can align with international standards. Preexisting guidelines from the Lymphology Association of North America (LANA) pertaining to the number of hours that is expected for examination candidacy have been established since 1998. LANA recommends that certified lymphedema therapist candidates have 135 classroom hours with one-third theoretical

instruction and two-third practical laboratory work,⁴¹ which could be considered beyond entry-level lymphology education but could serve as a foundation for future deliberations to establish commonality in time and content across professional DPT curricula. While specialty certifications may not be expected for professional DPT students, a thorough comprehension of the lymphatic system, lymphedema, and chronic edema⁴² management may need to be explicated. A structured process (eg, modified Delphi) could be used among experts to make recommendations on professional DPT lymphology education content and practices.

In conclusion, according to the analyses of these survey responses, consistent content and format (didactic and laboratory hours) are lacking with regard to lymphatic system examination skills and intervention techniques within the professional DPT programs. The variability of hours was significant, with one program's cumulative hourly investment in lymphology content to be 2 hours while another school's cumulative hours were 40 (Table 3). The rationale for this unexpected variability was not investigated in this study. The cumulative hours for professional DPT lymphology curriculum content may depend on the overall objective. If a curriculum's lymphology content is focused upon the disease of lymphedema, with the expectation that an entry-level physical therapist can confidently employ patient referral or pursue CDT specialization later, then fewer hours consisting mainly of didactic education may be sufficient. Whereas if the premise is that the lymphatic system is involved in all types of edema (eg, dynamic, static, and combined lymphatic insufficiencies), in all stages of healing (eg, acute, subacute, chronic), affecting multiple tissues (eg, integumentary, musculoskeletal, and neurological), and seen across all patient populations and practice settings, then a greater number of education hours may be expected. Although NPTE lymphatic system results are unavailable for analysis, inconsistencies in curriculum topics and hours of didactic and laboratory hours may result in educational gaps. There is evidence for opportunities in developing optimal and congruous professional entry-level lymphology education in order to provide patient-centered evidence-based lymphatic examinations and interventions. Mixed-methods research might allow further exploration of the variability of hours and further description of professional DPT education practice as it relates to lymphology.

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