RESEARCH REPORT

Use of Outcome Measures by Certified Lymphedema Therapists With Survivors of Breast Cancer With Breast Cancer–Related Lymphedema

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Background: Survivors of breast cancer (SBC) with breast cancer–related lymphedema (BCRL) have demonstrated neuromusculoskeletal restrictions, sensorimotor impairments, postural instability, and balance deficits. To date, there have been no studies that investigate outcome measures (OMs) used by certified lymphedema therapists (CLTs) with SBC with BCRL. **Objective:** The purposes of this study were to (1) determine types of OMs used and their frequency of use by CLTs with SBC with BCRL and their differences between therapy professions, and (2) identify unique characteristic predictors for use of OMs. **Methods:** Cross-sectional online survey research design. Electronic surveys were distributed to CLTs from various institutions. Data from 70 physical therapists (PTs) and 41 occupational therapists were analyzed from 130 completed surveys. **Results:** Sixteen OMs used most often assessed joint function, flexibility, strength, pain, volume, sensation, tissue consistency, body composition, health-related quality of life, and upper quadrant function. There were differences between PTs and occupational therapists in use of OMs. Lymphology Association of North America certification, practice setting, and profession (physical therapy and occupational therapy) predicted the use of some OMs. **Conclusions:** This study identified individual OMs used on SBC with BCRL in clinical practice among interdisciplinary CLTs. The number of OMs used to assess body functions and structures exceed those OMs for activities and participation, which may be influenced by CLT profession, Lymphology Association of North America certification, and level of highest degree. **(Rehab Oncol 2022;000:1–13)** *Key words: breast cancer, lymphedema, outcome measures*

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Outcome measures (OMs) are an essential component of evidence-based practice. Outcome measures provide a foundation for clinical reasoning in the diagnosis, prognosis, and establishment of intervention and/or management of a health condition. Using OMs in the clinical setting is key to providing patient-centered care and value-based health services and can justify the efficacy of a plan of care for chronic conditions.[1] Breast cancer–related lymphedema (BCRL) is a chronic condition that may develop in survivors of breast cancer (SBC) as a consequence of cancer treatment.[2] Survivors of breast cancer with BCRL may experience body function and structure impairments, such as pain, edema, limited range of motion, decreased strength, and sensory deficits, as well activity limitations and participation restrictions.[2-5] Because of the number of problems SBC with BCRL may experience, a variety of OMs are likely necessary to assess health status and quality of life.

Fortunately, organizations have made recommendations on OMs used for cancer survivors and BCRL. In 2010, the American Physical Therapy Association (APTA) Oncology Section formed the Breast Cancer–Evaluation Database to Guide Effectiveness (EDGE) Task Force to identify tests/ OMs that were reliable, valid, and had good clinical utility for individuals treated for breast cancer.[6] Systematic reviews[7,8] have been published by the Breast Cancer EDGE Task Force work groups, providing recommendations for use of outcomes in survivors of breast cancer (Table 1). In 2013, the Dutch Society of Dermatology organized a task force to create guidelines for evaluation and treatment of lymphedema[9] that are based on an interdisciplinary approach to lymphedema and included broad subdomains of measures under the International Classification of Functioning, Disability, and Health (ICF) domains of body functions and structures, and activities and participation (Table 1). A clinical practice guideline (CPG) was developed by the Oncology Section of the APTA and published in 2017[10] focusing on the diagnosis of upper-quadrant lymphedema secondary to breast cancer (Table 1). Although these documents list recommended OMs, uncertainty remains as to what OMs are used and their frequency of use by health care providers who assist SBC with BCRL.

Certified lymphedema therapists (CLTs) are specialists with 135 hours of training who care for lymphedematous conditions, including BCRL, and include professionals such as physical therapists (PTs), occupational therapist (OTs), massage therapists (MTs), nurses (RNs), or physicians (MDs).[11] Previous research suggests that the use of OMs across a number of health care disciplines[12,13] has been limited over the last decade and there have been limited comparisons of use of OMs among various profession.[13] Demographics have been associated with the use of OMs including profession[14] and highest degree earned.[12] Past studies have reported a greater use of OMs by PTs compared with OTs,[15] and MDs and RNs compared with PTs and OTs.[13] Studies have not investigated the use of OMs by CLTs with SBC with BCRL. Factors related to the use of OMs by CLTs with SBC with BCRL have not been previously explored. We hypothesized that the number of impairment-based OMs would be used most often compared with OMs that assess activity and participation. The purposes of this study were to (1) determine the types of OMs used and their frequency of use by CLTs with SBC with BCRL and their differences between therapy professions and (2) identify unique characteristic predictors for use of OMs.

METHODS

Design and Subjects

A cross-sectional, online survey design was developed, which gathered responses from CLTs from various postprofessional lymphedema continuing education programs and/or members-related professional associations in the United States. Certified lymphedema therapists who did not see patients with BCRL were excluded from the study.

Instrument

An online survey was constructed through Qualtrics software, Version June 2020. The survey was constructed around similar validated surveys.[11,12,16] The survey was divided into 2 domains: (1) demographics and practice characteristics of respondents and (2) levels of use of standardized and clinically relevant OMs. The survey included 92 OMs that respondents rated level of use for each OM as not used, frequently used, occasionally used, and seldom used. Outcome measures included in our survey were chosen on the basis of a review of the literature on OMs recommended for use with SBC with BCRL. Additional OMs were added on the basis of our knowledge and opinion about possible OMs used in clinical practice by CLTs.

The questionnaire was piloted by 6 CLTs. Each CLT was asked to rate survey items on clarity and relevance based upon its breadth for capturing OMs used in clinical practice. Validity was determined by calculating the item-level content validity index (I-CVI) and the average I-CVI of the overall tool.[17] An agreement between a minimum of 2[18] CLTs with BCRL experience on the survey instrument was considered sufficient. The I-CVI scored high for the demographic domain (I-CVI = 0.83-1.00) and OMs subdomains (I-CVI = 1.00). The average I-CVI for the survey tool was 0.99 out of 1.00.

Procedures

The study received exempt status by the Health Sciences and Behavioral Sciences Institutional Review Board of the University of Michigan-Flint and from the A.T. Still University—Arizona Institutional Review Board. Approximately 7000 survey links were emailed to CLT graduates from 6 institutions. After giving written consent, the participants completed the online survey, which was available for 53 days. A follow-up email was sent 16 days after the initial invitation and another institution was included

TABLE 1

Oncology Section Breast Cancer EDGE Task Force,[7-8] Upper-Quadrant Lymphedema Guideline,[10] and Dutch Lymphedema Guideline–Recommended Outcome Measures.[9]

ICF Domains of Body Functions and Body Structures	EDGE Rating Scale	Clinical Practice Guideline	Dutch Lymphedema Guideline		
			Secondary Prevention Assessment	Intensive Treatment Assessment	Maintenance Assessment
Measures of joint function					
Goniometry—passive range of motion	4			X	X
Goniometry—active range of motion	3			X	X
Inclinometer—passive range of motion	3				
Inclinometer—active range of motion	3				
Measures of flexibility					
Muscle length—pectoralis minor	3				
Muscle length—pectoralis minor via Borstad scapular index	3				
Stiffness of glenohumeral joint	3				
Measures of strength					
Hand grip strength	3			X	AI
Hand-held dynamometry	3			X	AI
Measures of volume					
Bioelectrical impedance spectroscopy	4	B			
Circumference	4	B	X	X	X
Perometer			X	X	X
Water displacement (volumeter)	4	B	X	X	X
Measures of pain					
Brief Pain Inventory	4				
Brief Pain Inventory—Short Form	4				
McGill Pain Questionnaire	4				
McGill Pain Questionnaire—Short Form	4				
Numeric Pain Rating Scale	4				
Pain Disability Index	4				
Visual analog scale—pain	4			X	X
Measures of tissue consistency					
Pitting Test			X	X	X
Ultrasonography		B			
Measures of body composition					
Body weight, body mass index			X	X	X

ICF Domains of Activities and Participation	EDGE Rating Scale	Dutch Lymphedema Guideline		
		Secondary Prevention Assessment	Intensive Treatment Assessment	Maintenance Assessment
Measures of patient reported function and QOL				
BREAST-Q	4			
EORTC Quality of Life Questionnaire—Breast	4			
Functional Assessment of Cancer Therapy—Breast	4			
Functional Assessment of Cancer Therapy—Breast+ 4	4			
Functional Assessment of Cancer Therapy/Gynecologic Oncology Group—Neurotoxicity(v4)	4			
Lymph—ICF Arm		X	X	
Upper Limb Lymphedema Measure—27		X	X	
Disability of Arm, Shoulder, & Hand Questionnaire	4		AI	AI
Penn Shoulder Score	4			
*Quick*DASH	3			
Shoulder Pain and Disability Index	4			
Shoulder Rating Questionnaire	4			
Measures of fatigue				
Bi-Dimensional Fatigue Scale /Chalder/Fatigue Questionnaire	3			
Brief Fatigue Inventory	4			
Diagnostic Interview for Cancer-Related Fatigue	3			
FACT-B	4			
Fatigue Symptom Inventory	3			
Functional Assessment of Chronic Illness Therapy—Fatigue	3			
MOS-SF36/Rand/Vitality	3			

(*continues*)

TABLE 1

Oncology Section Breast Cancer EDGE Task Force,[7-8] Upper-Quadrant Lymphedema Guideline,[10] and Dutch Lymphedema Guideline–Recommended Outcome Measures.[9] (*Continued*)

ICF Domains of Activities and Participation	EDGE Rating Scale	Dutch Lymphedema Guideline		
		Secondary Prevention Assessment	Intensive Treatment Assessment	Maintenance Assessment
Multidimensional Fatigue Symptom Inventory	4			
Piper Fatigue Scale Revised	3			
Profile of Mood States Fatigue/Vigor and Fatigue/Inertia Subscales	3			
Visual analog scale	3		AI	AI
Wu Cancer Fatigue Scale	3			
Measures of mobility and balance				
6-Minute Walk Test	3			
Fullerton Advanced Balance Scale	3			
Gait Analysis			AI	AI
Timed Up and Go	3			

Abbreviations: Clinical Practice Guideline Rating Scale: B—moderate recommendation, X—recommended for type of assessment, AI—as indicated; EDGE, EDGE Rating Scale: 4 = highly recommended, 3 = recommended; ICF, International Classification of Functioning, Disability, and Health; QOL, quality of life.

25 days after the outset for further dissemination of the survey.

Data Analysis

Data were analyzed using IBM SPSS version 26 (Armonk, New York). Groups were examined to understand their (1) demographic (Table 2) and (2) practice characteristics (Table 3) and were presented as means ± standard deviations, counts (n), and frequencies (%). Independent-samples *t* tests were used to analyze group differences for parametric data. Nonparametric data were analyzed with the χ^2 test of independence and the Mann-Whitney *U* test. Fisher exact test was used when more than 20% of cells had expected counts less than 5. Alpha level was set at 0.05 for all analysis.

The dependent variables were OMs and were separated in 2 categories: (1) OMs used by CLTs to measure ICF domains of body function and structure with levels of (*a*) joint function, (*b*) flexibility, (*c*) strength, (*d*) volume, (*e*) pain, (*f*) tissue consistency, (*g*) body composition, and (*h*) sensation (Table 4 and Figures 1 and 2); and (2) OMs used by CLTs to measure ICF domains of activity and participation with levels of (*a*) patient-reported function and health-related quality of life (HRQOL), (*b*) patient-reported upper quadrant (UQ) function, (*c*) patient-reported fatigue, (*d*) mobility and balance, and (*e*) upper extremity activity and motor control (Table 5 and Figures 3 and 4). To determine OMs used by CLTs, data were dichotomized into "used to some degree of frequency" (frequently, occasionally, and seldom used) and "not used," with frequencies reported as count and percentage of responses. For ease of reporting, the OMs were grouped by quantile cut points (0%-25%, 25.1%-50%, 50.1%-75%, and 75.1%-100%) based on their frequency of use (frequently, occasionally, and seldom), which divided the range of their use into equal probabilities (see Supplemental Digital Content 1, available at: http://links.lww.com/REHABONC/A38). Chi-square test of independence was used to show group differences in the use of OMs between groups, and when more than 20% of cells had expected counts less than 5, the Fisher exact test was implemented (Tables 4 and 5). Binary logistic regression was used to examine whether respondent demographic and practice characteristics uniquely predict the use of OMs retrieved from Tables 4 and 5.

RESULTS

Participants

The total sample of respondents (n = 130) included PTs, OTs, MTs, and RNs. Because of sparsity of respondents from MTs and RNs, the results included groups most represented, (1) OT CLTs (n = 41) and (2) PT CLTs (n = 70), and were collapsed for analysis (n = 111). Of those CLT respondents (n = 111) who use OMs on SBC with BCRL, most of the respondents were female, with an average age of 48 ± 10.6 years, which was not significantly different between PT and OT groups. The number of years in professional practice between PTs and OTs averaged 22.7 ± 11.6 years. More than 50% of PTs and OTs pursued National CLT certification through the Lymphology Association of North America (LANA). Respondents similarly reported a mean of 64.2% ± 29.2 of their practice devoted to lymphedema management. Respondent and practice characteristics and differences are presented in Tables 2 and 3.

Use of Outcome Measures

Measures Used to Assess ICF Domains of Body Function and Structures. The 5 OMs used most often by CLTs were circumference/volume measurements (99.1%, n = 110), goniometer active range of motion (AROM) (99.1%, n = 110), palpation—pitting edema test (98.2%, n = 109), manual muscle test (98.2%, n = 109), and palpation—tissue texture (97.3%, n = 108).

TABLE 2
Demographic Characteristics

Characteristic	Occupational Therapists	Physical Therapists	Significance of Difference
Occupation, n (%)	41 (37)	70 (63)	
Age, mean ± SD, y	47.8 ± 11.2	48.3 ± 10.3	$t = -0.27$, $P = .79$
Sex, n (%)			
Female	40 (97.6)	69 (98.6)	$P = 1.00$[a]
Male	1 (2.4)	1 (1.4)	
Ethnicity, n (%)			
Asian	4 (9.8)	1 (1.4)	$P = .06$[a]
Black or African American	1 (2.4)	1 (1.4)	
Other	0 (0)	3 (4.3)	
Prefer not to answer	1 (2.4)	0 (0)	
White	35 (85.4)	65 (92.9)	
Highest degree earned, n (%)			
Bachelor of arts or science	12 (29.3)	17 (24.3)	$\chi^2 = 11.24$, $P < .01$[b]
Master of arts or science	21 (51.2)	18 (25.7)	
Clinical doctorate	8 (19.5)	35 (50)	
Years in practice (n = 104), mean ± SD	21.6 ± 12.5	23.2 ± 11.2	$t = -0.67$, $P = .50$
Practice specialization[c], n (%)			
Acute care	8 (19.5)	4 (5.7)	$\chi^2 = 5.10$, $P = .03$[b]
Cardiovascular and pulmonary	1 (2.4)	1 (1.4)	$P = 1.00$[a]
Geriatric	6 (14.6)	0 (0)	$\chi^2 = 10.83$, $P < .01$[b]
Hand therapy	8 (19.5)	0 (0)	$\chi^2 = 14.72$, $P < .01$[b]
Manual therapy	5 (12.2)	7 (10)	$P = .76$[a]
Neurology	5 (12.2)	4 (5.7)	$P = .29$[a]
Obstetrics and gynecology	0 (0)	1 (1.4)	$P = 1.00$[a]
Oncology	11 (26.8)	14 (20)	$\chi^2 = 0.69$, $P = .48$
Orthopedic	5 (12.2)	9 (12.9)	$\chi^2 = 0.01$, $P = 1.00$
Plastic surgery	1 (2.4)	1 (1.4)	$P = 1.00$[a]
Sports	1 (2.4)	3 (4.3)	$P = 1.00$[a]
None	15 (36.6)	41 (58.6)	$\chi^2 = 5.00$, $P = .03$[b]
Other	4 (9.8)	9 (12.9)	$P = .76$[a]
Dichotomized			
Have a specialization	26 (63.4)	29 (41.4)	$\chi^2 = 5.00$, $P = .03$[b]
Not specialized	15 (36.6)	41 (58.6)	
CLT Institution Attended[c], n (%)			
ACOLS	19 (46.3)	26 (37.1)	$P = .42$[a]
Casley-Smith	2 (4.9)	1 (1.4)	$P = .55$[a]
Dr Vodder School International	0 (0)	2 (2.9)	$P = .53$[a]
ILWTI	0 (0)	2 (2.9)	$P = .53$[a]
Klose Training Lymphedema	9 (22)	18 (25.7)	$\chi^2 = .19$, $P = .82$
Certification Institutions			
Norton School of Lymphatic Therapy	6 (14.6)	18 (25.7)	$\chi^2 = 1.87$, $P = .23$
Pacific Therapy Education, Inc	1 (2.4)	1 (1.4)	$P = 1.00$[a]
Upledger—Chikly LLCC	0 (0)	2 (2.9)	$P = .53$[a]
UWM	9 (22)	1 (1.4)	$\chi^2 = 13.29$, $P < .01$
Other school	1 (2.4)	7 (10)	$P = .25$[a]
Years as CLT (n = 111), mean ± SD	11 ± 7.6	11 ± 10.0	$U = 1310$, $P = .73$[d]
LANA certified, n (%)	23 (56.1)	48 (68.5)	$\chi^2 = 1.75$, $P = 1.86$

Abbreviations: ACOLS, Academy of Lymphatic Studies; CLT, certified lymphedema therapist; ILWTI, International Lymphedema and Wound Training Institute; LANA, Lymphology Association of North America; LLCC, LDT Lymphedema Complex Decongestive Therapy Certification; n, percentage of cases; UWM, University of Wisconsin-Milwaukee.
[a]Fisher exact test.
[b]Significant.
[c]Multiple response variable.
[d]Mann-Whitney *U* test.

Tonometer (7.2%, n = 8) and SkinFibroMeter (5.4%, n = 6), which quantify tissue resistance to pressure, were used least often (see Supplemental Digital Content 1, available at: http://links.lww.com/REHABONC/A38). Significant group differences (*P* value less than .05) in use of OMs included stiff glenohumeral joint, dynamic motion of scapula, and pectoralis major and minor length, with PTs using these measures more often (Table 4).

Measures to Assess ICF Domains of Activities and Participation. The Lymphedema Life Impact Scale (LLIS) (patient-reported HRQOL) and the *Quick*DASH (patient-reported UQ function) were the OMs used most often (82.9%, n = 92 and 85.6%, n = 95, respectively) (Table 5).

TABLE 3
Practice Characteristics

Characteristic	Occupational Therapists	Physical Therapists	Significance of Difference
Type of practice setting, n (%)			
Acute and subacute care	4 (9.8)	3 (4.3)	$P = .42$[a]
Outpatient clinic	37 (90.2)	67 (95.7)	
Geographical practice location, n (%)			
Midwest US	17 (41.4)	17 (24.3)	$P = .20$[a]
Northeast US	5 (12.2)	19 (27.2)	
Southeast US	11 (26.8)	14 (20)	
Southwest US	4 (9.8)	7 (10)	
West US	4 (9.8)	12 (17.1)	
Neither US nor Canada	0 (0)	1 (1.4%)	
Community setting, n (%)			$\chi^2 = 10.66$, $P < .01$[b]
Rural	15 (36.6)	8 (11.4)	
Suburban	12 (29.3)	35 (50)	
Urban	14 (34.1)	27 (38.6)	
Percentage of practice devoted to lymphedema treatment, mean ± SD	66 ± 31.7	63.1 ± 27.8	$U = 1283$, $P = .35$[c]
Number of BCRL clients in 8 h work day, mean ± SD	3 ± 2.0	4 ± 3.4	$U = 1683$, $P = .07$[c]
Minutes allocated for initial evaluation, mean ± SD	61 ± 24.6	59 ± 13.2	$U = 1278$, $P = .29$[c]
Minutes allocated for reevaluation, mean ± SD	54 ± 20.6	55 ± 11.2	$U = 1411$, $P = .87$[c]
Hours per week providing lymphedema treatment, mean ± SD	14 ± 13.2	15 ± 10.7	$U = 1550$, $P = .39$[c]
Percentage of patients in age group, mean ± SD			
<21 y	0.25 ± 1.1	0.96 ± 6.0	$U = 1487$, $P = .48$[c]
21-40 y	14.4 ± 13.2	14.6 ± 10.3	$U = 1539$, $P = .52$[c]
41-60 y	39.0 ± 19.5	41.6 ± 15.0	$U = 1649$, $P = .19$[c]
61-75 y	32.8 ± 16.0	30.6 ± 14.8	$U = 1329$, $P = .51$[c]
>75 y	13.9 ± 12.4	12.5 ± 12.0	$U = 1319$, $P = .47$[c]
Treat other conditions with LE, n (%)[d]			
Arthritis	16 (39)	29 (41.4)	$\chi^2 = 0.06$, $P = .80$
CVI	40 (97.6)	59 (84.3)	$P = .05$[a,b]
Filariasis	4 (9.8)	4 (5.7)	$P = .46$[a]
Head and Neck LE	30 (73.2)	62 (88.6)	$\chi^2 = 4.32$, $P = .04$[b]
Lipedema	31 (75.6)	59 (84.3)	$\chi^2 = 1.27$, $P = .26$
Neurological	21 (51.2)	37 (52.9)	$\chi^2 = 0.03$, $P = .87$
Reproductive organ cancer	28 (68.3)	54 (77.1)	$\chi^2 = 1.05$, $P = .31$
Orthopedic conditions	36 (87.8)	46 (65.7)	$\chi^2 = 6.54$, $P = .01$[b]
Postoperative general	25 (61)	34 (48.6)	$\chi^2 = 1.60$, $P = .21$
Postoperative orthopedic	31 (75.6)	43 (61.4)	$\chi^2 = 2.34$, $P = .13$
Primary lymphedema	33 (80.5)	57 (81.4)	$\chi^2 = 0.02$, $P = .90$
Wounds	36 (87.8)	3 (4.3)	$\chi^2 = 7.25$, $P = .01$[b]
None	0 (0)	2 (2.9)	$P = .53$[a]
Other	3 (7.3)	3 (4.3)	$P = .67$[a]

Abbreviations: BCRL, breast cancer–related lymphedema; CVI, chronic venous insufficiency; LE, lymphedema; n, percentage of cases.
[a]Fisher exact test.
[b]Significant.
[c]Mann-Whitney *U* test.
[d]Multiple response variable.

Occupational therapists used the LLIS more often than PTs (χ^2_1 (n = 111) = 4.40, $P = .04$). Other OMs that are used to measure activities and participation (Table 5) include (1) DASH (73.0%, n = 81) for patient-reported UQ function with no significant difference between groups (χ^2_1 (n = 111) = 1.86, $P = .19$), (2) visual analog scale (55.0%, n = 61) for patient-reported fatigue with PTs using it more often that OTs (χ^2_1 (n = 111) = 4.78, $P = .03$), and (3) Timed up and Go (73%, n = 81) for mobility and balance, which PTs use more often that OTs (χ^2_1 (n = 111) = 12.30, *P* value less than .01). All OMs listed under the category of upper extremity activity and motor control were used least often (see Supplemental Digital Content 1, available at: http://links.lww.com/REHABONC/A38).

Characteristics Influencing Use of Outcome Measures

Profession, certification status, and level of degree predicted the use of some OMs. Certified lymphedema

TABLE 4

Group Differences in Use of Outcome Measures in the Third and Fourth Quartiles That Measure Domains of Body Functions and Body Structures

Domain Outcome Measure, Level of Use	Occupational Therapists n (%)	Physical Therapists n (%)	PT and OT n (%)	Significance of Difference
Joint function				
Dynamic motion of scapula				
Use at some frequency	23 (56.1)	53 (75.7)[a]	76 (68.5)	$\chi^2 = 4.61$, $P = .04$[b]
Do not use	18 (43.9)[a]	17 (24.3)	35 (31.5)	
Goniometer PROM				
Use at some frequency	37 (90.2)	69 (98.6)	106 (95.5)	
Do not use	4 (9.8)	1 (1.4)	5 (4.5)	$P = .06$[c]
Goniometer AROM				
Use at some frequency	40 (97.6)	70 (100)	110 (99.1)	
Do not use	1 (2.4)	0 (0)	1 (0.9)	$P = .37$[c]
Flexibility				
Pectoralis major length				
Use at some frequency	20 (48.8)	61 (87.1)[a]	81 (73)	$\chi^2 = 19.29$, $P < .01$[b]
Do not use	21 (51.2)[a]	9 (12.9)	30 (27)	
Pectoralis minor length				
Use at some frequency	18 (43.9)	59 (84.3)[a]	77 (69.4)	$\chi^2 = 19.84$, $P < .01$[b]
Do not use	23 (56.1)[a]	11 (15.7)	34 (30.6)	
Stiff glenohumeral joint				
Use at some frequency	35 (85.4)	69 (98.6)[a]	104 (93.7)	
Do not use	6 (14.6)[a]	1 (1.4)	7 (6.3)	$P < .01$[b,c]
Strength				
Hand grip dynamometer				
Use at some frequency	38 (92.7)	60 (85.7)	98 (88.3)	$P = .37$[c]
Do not use	3 (7.3)	10 (14.3)	13 (11.7)	
Hand-held dynamometry				
Use at some frequency	26 (63.4)	46 (65.7)	72 (64.9)	$\chi^2 = 0.06$, $P = .84$
Do not use	15 (36.6)	24 (34.3)	39 (35.1)	
Manual muscle test				
Use at some frequency	40 (97.6)	69 (98.6)	109 (98.2)	$P = 1.00$[c]
Do not use	1 (2.4)	1 (1.4)	2 (1.8)	
Pinch dynamometer				
Use at some frequency	38 (92.7)[a]	35 (50)	73 (65.8)	$\chi^2 = 20.92$, $P < .01$[b]
Do not use	3 (7.3)	35 (50)[a]	38 (34.2)	
Volume and/or TWC				
Circumference/volume				
Use at some frequency	40 (97.6)	70 (100)	110 (99.1)	$P = .37$
Do not use	1 (2.4)	0 (0)	1 (0.9)	
Pain				
Numeric Pain Scale				
Use at some frequency	39 (95.1)	66 (94.3)	105 (94.6)	
Do not use	2 (4.9)	4 (5.7)	6 (5.4)	$P = 1.00$[c]
Visual analog scale				
Use at some frequency	32 (78)	60 (85.7)	92 (82.9)	
Do not use	9 (22)	10 (14.3)	19 (17.1)	$\chi^2 = 1.07$, $P = .43$
Sensation				
Light touch brushing				
Use at some frequency	38 (92.7)	68 (97.1)	106 (95.5)	$P = .36$[c]
Do not use	3 (7.3)	2 (2.9)	5 (4.5)	
Monofilament				
Use at some frequency	31 (75.6)[a]	38 (54.3)	69 (62.2)	$\chi^2 = 4.99$, $P = .03$[b]
Do not use	10 (24.4)	32 (45.7)[a]	42 (37.8)	
Sharp-dull discrimination				
Use at some frequency	34 (82.9)	46 (65.7)	80 (72.1)	$\chi^2 = 3.81$, $P = .08$
Do not use	7 (17.1)	24 (34.3)	31 (27.9)	
Two-point discrimination				
Use at some frequency	32 (78)[a]	39 (55.7)	71 (64)	$\chi^2 = 5.60$, $P = .02$[b]
Do not use	9 (22)	31 (44.3)[a]	40 (36)	

(*continues*)

TABLE 4

Group Differences in Use of Outcome Measures in the Third and Fourth Quartiles That Measure Domains of Body Functions and Body Structures (*Continued*)

Domain Outcome Measure, Level of Use	Occupational Therapists n (%)	Physical Therapists n (%)	PT and OT n (%)	Significance of Difference
Tissue consistency				
Pitting Edema Test—palpation				
Use at some frequency	39 (95.1)	70 (100)	109 (98.2)	$P = .13$[c]
Do not use	2 (4.9)	0 (0)	2 (1.8)	
Tissue texture—palpation				
Use at some frequency	39 (95.1)	69 (98.6)	108 (97.3)	$P = .55$[c]
Do not use	2 (4.9)	1 (1.4)	3 (2.7)	
Body composition				
Body weight				
Use at some frequency	40 (97.6)	61 (87.1)	101 (91)	$P = .09$[c]
Do not use	1 (2.4)	9 (12.9)	10 (9)	
Body mass index				
Use at some frequency	37 (90.2)	58 (82.9)	95 (85.6)	$\chi^2 = 1.14$, $P = .40$
Do not use	4 (9.8)	12 (17.1)	16 (14.4)	

Abbreviations: AROM, active range of motion; OT, occupational therapist; PROM, passive range of motion; PT, physical therapist; TWC, tissue water content.

[a]Standardized residuals and percentage were used to demonstrate strength of the group to the χ^2 value.

[b]Significant.

[c]Fisher exact test.

therapists who are OTs are 11 times more likely to use the pinch dynamometer OM to assess strength (P value less than .01, odds ratio [OR] = 11.36; 95% confidence interval [CI], 2.61-49.45) and 3 times more likely to use the monofilament OM to assess sensation ($P = .04$, OR = 3.01; 95% CI, 1.08-8.39) than PTs. Certified lymphedema therapists who are not LANA certified are nearly 4 times more likely to use the sharp-dull discrimination OM for sensation ($P = 0.03$, OR = 3.65; 95% CI, 1.14-11.69) and the DASH OM for patient-reported UQ function ($P = 0.02$, OR = 4.37; 95% CI, 1.31-14.59) and are 3 times more likely to measure fatigue with the visual analog scale OM ($P = 0.03$, OR = 3.23; 95% CI, 1.13-9.24). Certified lymphedema therapists with their highest professional degree being masters of science or art are nearly 4 times more likely to use the functional reach OM to assess mobility and balance ($P = .02$, OR = 3.65; 95% CI, 1.26-10.53).

Fifteen Outcome Measures Used Most Often

Recommended OMs from the EDGE Task Force, CPG from the Oncology Section of the APTA, and the Dutch Lymphedema Guideline assessing ICF domains identified as used most often include (1) circumference for volume,

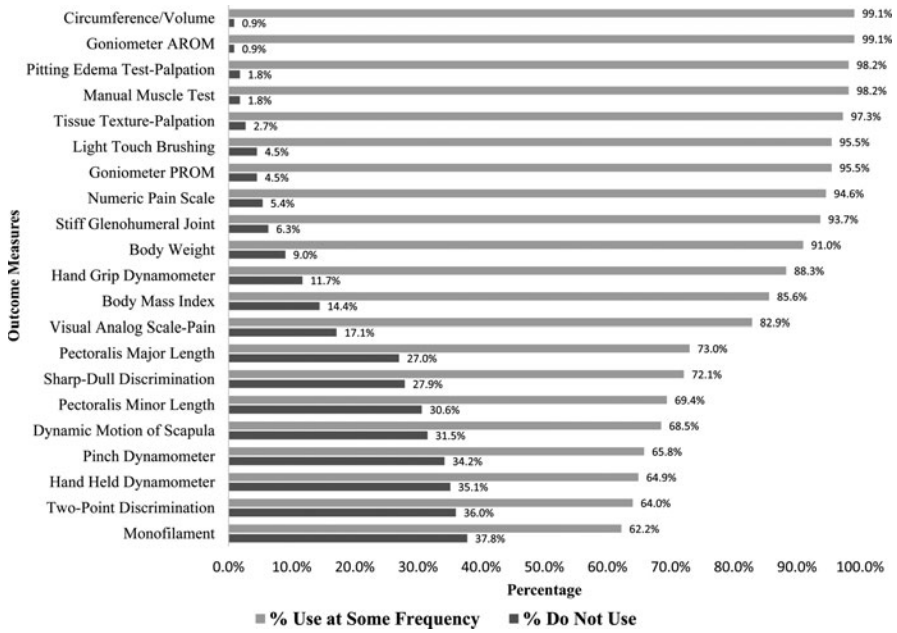

Fig. 1. Use of outcome measures in the third and fourth quartiles that measure domains of body functions and body structures. AROM indicates active range of motion; PROM, passive range of motion.

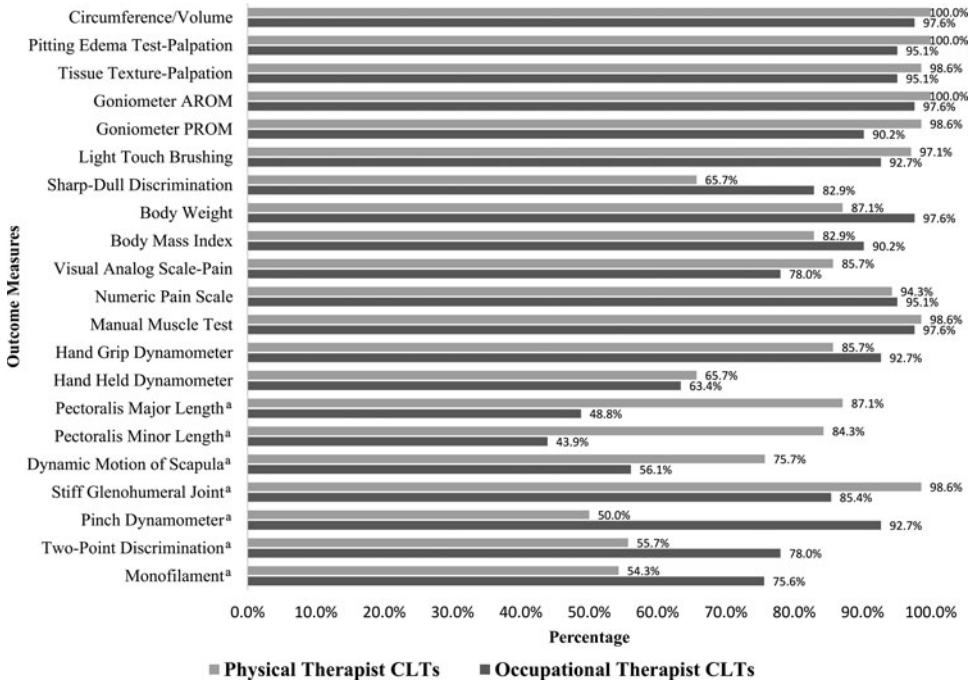

Fig. 2. Group differences in use of outcome measures in the third and fourth quartiles that measure domains of body functions and body structures. [a]Significance of difference, $P < .05$. AROM indicates active range of motion; CLTs, certified lymphedema therapists; PROM, passive range of motion.

(2) pitting edema test for tissue consistency, (3) numeric pain scale for pain, (4) goniometry AROM for joint function, (5) stiffness of the glenohumeral joint for flexibility, (6) goniometry passive range of motion (PROM), (7) *Quick*Dash for patient-reported UQ function, (8) body weight for body composition, (9) visual analog pain scale, (10) body mass index, and (11) hand grip dynamometer for strength. Other OMs used most often include (1) tissue texture-palpation for tissue consistency, (2) light touch brushing for sensation, (3) LLIS for HRQOL, and (4) manual muscle testing for strength.

DISCUSSION

Participants

The participants made up an equitable sample of PT and OT CLTs presumed present in the population compared with a 2010 national (n = 415) and a 2018 international survey (n = 950) investigating practice environments, patient characteristics, and educational frameworks of CLTs.[19,20] This sample deviated from the 2018 survey with 64% (n = 71) of this study's respondents being LANA certified (compared with 33%) and a professional work history of 22.5 years (range: 1-45) (compared with 10.7 years).

OMs That CLTs Use to Measure Body Functions and Structures

Current CPGs that focus on the diagnosis and interventions of BCRL[10,21] recommend using circumferential measurements for calculated volume, which aligns with what is currently being used by CLTs as noted in this study. This OM may not be appropriate for subclinical/stage 0 BCRL, with the recommendation to use bioimpedance analysis,[10] which is used least often (20.7%) by this sample of CLTs. The availability and cost of such devices may be an issue for their use. Additional OMs currently being used most often by CLTs include (1) numeric pain scale, (2) goniometry for PROM and AROM, (3) stiffness of the glenohumeral joint for flexibility, (4) hand grip dynamometer, and (5) manual muscle test (MMT), which have all been analyzed via systematic review by the Breast Cancer EDGE Task Force of the Oncology Section of the APTA.[6] MMT was not recommended for use due to insufficient information on individuals with or postcancer, whereas hand-held dynamometry is recommended for clinical practice. Body weight (91%, n = 101) and body mass index (85.6%, n = 95) were used most often by the CLT respondents and their use was recommended by the Dutch Society of Dermatology.[9] Pitting edema test via palpation was used most often to measure tissue consistency and has been vetted by systematic analysis but was not recommended for use due to absence of diagnostic accuracy.[10] Ultrasonography, recommended in the BCRL CPG to assess underlying tissue changes for stage III BCRL,[10] was used by only 6.3% of respondents. Other tissue consistency OMs used on BCRL that were used least often (0%-25%) include the SkinFibroMeter, tonometer (eg, Durometer), and the Myoton. This demonstrates minimal use of available quantitative OMs to assess tissue consistency, a component for staging lymphedema according to the International Society of Lymphology staging system.[22] However, again, availability and cost may be an issue for

TABLE 5

Group Differences in Use of Outcome Measures in the Third and Fourth Quartiles That Measure Domains of Activities and Participation

Domain Outcome Measure, Level of Use	Occupational Therapists n (%)	Physical Therapists n (%)	PT and OT n (%)	Significance of Difference
Patient-reported HRQOL				
Lymphedema Life Impact Scale				
Use at some frequency	38 (92.7)[a]	54 (77.1)	92 (82.9)	$\chi^2 = 4.40$, $P = .04$[b]
Do not use	3 (7.3)	16 (22.9)[a]	19 (17.1)	
Patient-reported UQ function				
DASH				
Use at some frequency	33 (80.5)	48 (68.6)	81 (73)	$\chi^2 = 1.86$, $P = .19$
Do not use	8 (19.5)	22 (31.4)	30 (27)	
*Quick*DASH				
Use at some frequency	38 (92.7)	57 (81.4)	95 (85.6)	$\chi^2 = 2.66$, $P = .16$
Do not use	3 (7.3)	13 (18.6)	16 (14.4)	
Patient-reported fatigue				
Visual analog scale				
Use at some frequency	17 (41.5)	44 (62.9)[a]	61 (55)	
Do not use	24 (58.5)[a]	26 (37.1)	50 (45)	$\chi^2 = 4.78$, $P = .03$[b]
Mobility and balance				
Berg Balance Scale				
Use at some frequency	21 (51.2)	54 (77.1)[a]	75 (67.6)	$\chi^2 = 7.93$, $P < .01$[b]
Do not use	20 (48.8)[a]	16 (22.9)	36 (32.4)	
Functional Reach				
Use at some frequency	20 (48.8)	39 (55.7)	59 (53.2)	
Do not use	21 (51.2)	31 (44.3)	52 (46.8)	$\chi^2 = 0.50$, $P = .56$
Timed Up and Go				
Use at some frequency	22 (53.7)	59 (84.3)[a]	81 (73)	
Do not use	19 (46.3)[a]	11 (15.7)	30 (27)	$\chi^2 = 12.30$, $P < .01$[b]
5× Sit to Stand				
Use at some frequency	11 (26.8)	50 (71.4)[a]	61 (55)	
Do not use	30 (73.2)[a]	20 (28.6)	50 (45)	$\chi^2 = 20.78$, $P < .01$[b]
6-Minute Walk Test				
Use at some frequency	12 (29.3)	44 (62.9)[a]	56 (50.5)	
Do not use	29 (70.7)[a]	26 (37.1)	55 (49.5)	$\chi^2 = 11.67$, $P < .01$[b]
UE activity and motor control	NA	NA	NA	NA

Abbreviations: DASH, Disability of Arm, Shoulder, and Hand; HRQOL, health-related quality of life; NA, OMs did not meet 50% threshold; OT, occupational therapist; PT, physical therapist; UQ, upper quadrant.

[a]Standardized residuals and percentages were used to demonstrate strength of the group to the χ^2 value.

[b]Significant.

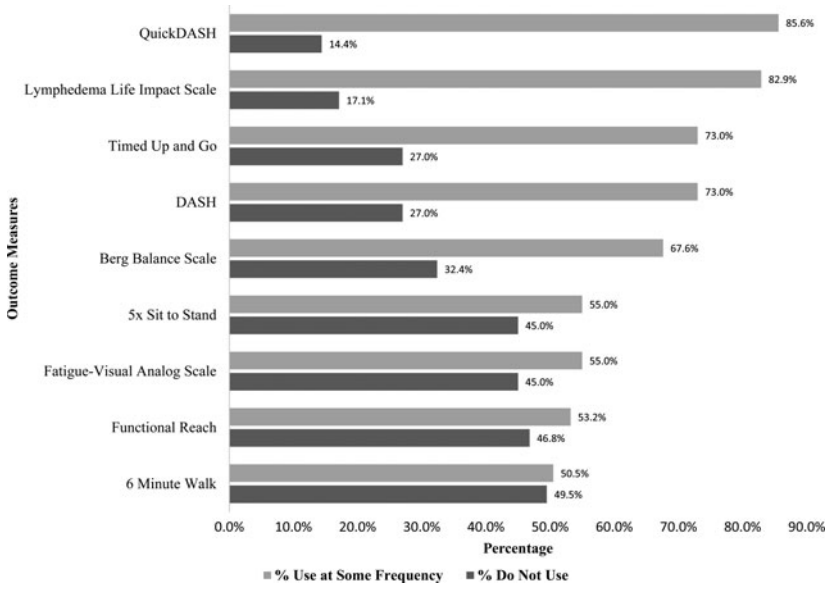

Fig. 3. Use of outcome measures in the third and fourth quartiles that measure domains of activities and participation.

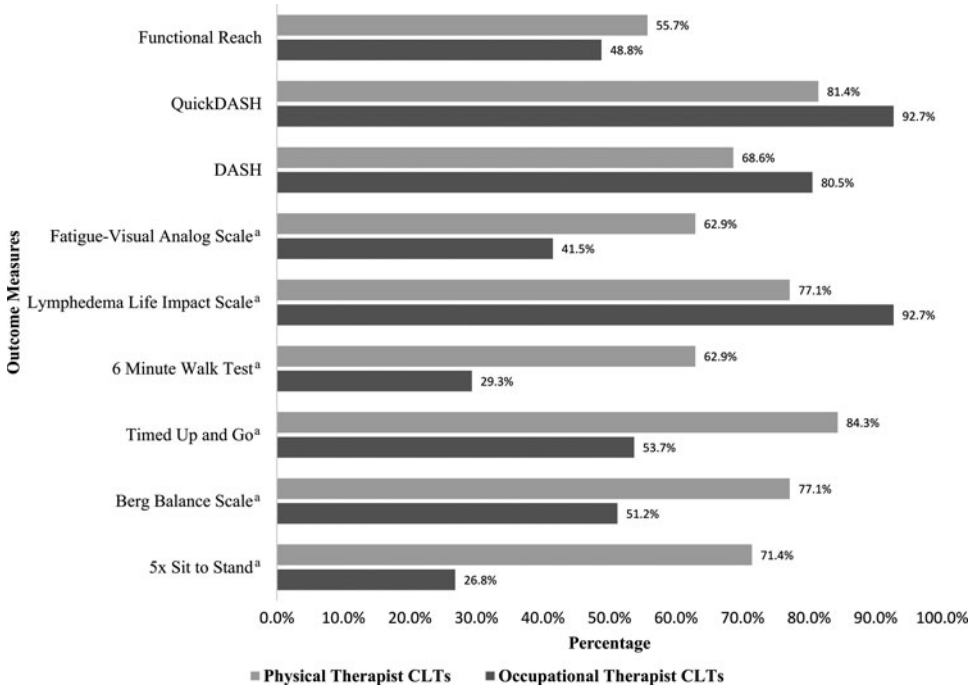

Fig. 4. Group differences in use of outcome measures in the third and fourth quartiles that measure domains of activities and participation. [a]Significance of difference, $P < .05$. CLTs indicates certified lymphedema therapists.

their use. Six OMs used by CLTs for body functions and structures, including dynamic motion of scapula, stiffness of glenohumeral joint, tissue texture-palpation, pitting edema test-palpation, pectoralis major and minor length, and manual muscle test, may present with psychometric limitations for clinical settings involved in care for SBC and BCRL, limiting objective findings needed to demonstrate effective progress and efficacy of interventions. Without use of valid and reliable objective measures for basics such as sensation, strength, and tissue consistency, there are limitations in transfer of care, identification of comorbidities, and guidance for clinical reasoning on interventions. Without objective measures of tissue consistency, accuracy of fluid volume reduction versus reduction in fibrosis remains elusive and is detrimental for continuum of care.

OMs That CLTs Use to Measure Activities and Participation

Our results concur with the hypothesis that the number of impairment-based OMs would be used most often compared with OMs that assess activity and participation. Certified lymphedema therapists are not frequently measuring upper extremity activity and motor control with objective and quantifiable OMs, as all measures assessed were found to reside in the first quartile (0%-25%) of probability distributions. Respondents use the LLIS and/or *Quick*DASH most often to measure activities and participation. The *Quick*DASH has been recommended by the EDGE Task Force and has been determined to be a valid and reliable measure for SBC[23] but not specifically for BCRL. The LLIS is a validated patient-reported HRQOL OM, but recent studies using COSMIN have not recommended its use on BCRL.[24]

Group Differences and Unique Predictors to the Use of OMs

Nearly half of the OMs in the third and fourth quartiles demonstrated significant differences in usage between PTs and OTs. This may result in the inability to compare patient outcomes between professions and can interfere with transition and continuum of care if standardized OMs are not routinely used by CLTs. Specializations[12] may offer plausible explanation for these differences; however, this characteristic does not lend to a consistent explanation. For instance, there were significant group differences in the use of volumeter, pinch dynamometer, monofilament, and 2-point discrimination with OTs using it most often, which may be attributed to the fact that significantly (P value less than .01) more OTs identified as being credentialed hand therapists (19.5%, n = 8) compared with PTs (0.0%, n = 0). This trend is also seen with least often used upper extremity activity and motor control OMs. However, hand therapy specialization is associated only with the use of pinch dynamometer ($P = .05$) and the Purdue Peg Board test (P value less than .01). There may be other reasons for group differences that were not investigated in this study, such as business practice and professional role identification within a practice. The mobility and balance OMs were most often used by PTs despite that the OTs identified as having specialties in geriatrics (14.6%, n = 6) and acute care (19.5%, n = 8) more than PTs (χ^2_1 [n = 111] = 10.83, P value less than .01; χ^2_1 [n = 111] = 5.10, $P = .03$, respectively), and having a neurology specialty was similar in both groups ($P = 0.29$). In fact, respondents in this study who identified as being credentialed in geriatrics or neurology used the 9 Hole Peg Test ($P = .01$ and P value less than .01, respectively), Box and Block Test ($P = 0.03$

and *P* value less than .01, respectively), Purdue Peg Board Test ($P = .03$ and *P* value less than .01, respectively), and the Volumeter ($P = .02$ and $P = .02$, respectively). Although associations exist between credentialed specializations and use of OMs, commonplace trends related to profession are not fully evident. Significant predictors for the use of OMs included profession, LANA certification, and highest degree earned. Profession,[14] specialization,[12] and highest degree earned[25] have been previously reported as being associated with use of OMs and our results concur to a limited extent. Of interest was that despite the difference in use of OMs between PTs and OTs, profession did not consistently present as a predictor for the same OMs that showed differences between professions.

Postprofessional Education on OMs for SBC With BCRL

Certified lymphedema therapists from various professional backgrounds are trained from institutions that have curriculums deemed suitable to prepare enrollees for clinical practice. Previous studies suggest that therapists practicing with a specialty tend to use OMs,[25] and perhaps the best placement for advance education on OMs for BCRL outside of entry-level OM skill sets should be included in the training for CLTs. The mission of LANA is to provide "standards for the certification of healthcare professionals who help individuals with lymphedema and/or related disorders manage their lymphedema and to promote lymphedema awareness and the science of lymphology."[26] According to the Policy and Procedures Manual (2020), LANA has listed foundational concepts in the field of lymphedema that are needed to prepare CLTs from training programs for the LANA examination.[26] This foundational content includes the theoretical instruction and practical laboratory work for all components of complete decongestive therapy.[26] The manual lacks specific language pertaining to curriculum on OMs for the assessments used on individuals with lymphedema. The LANA Candidate Information Booklet—examination content outline delineates topics that would require the use of OMs such as (1) differentiating edema etiologies and (2) conducting examination (eg, weight, limb appearance, range of motion).[11] Identifying OMs with good psychometric properties for the examination on SBC with BCRL, including the associated comorbidities, benefits the CLTs regardless of their professional background.

Consensus-Based Core Outcome Set

Implementing a consensus-based set of outcomes, also known as a core outcome set (COS), on SBC with BCRL is a worthy endeavor for all allied stakeholders. A COS can be an essential component of evidence-based practice, which can be used in clinical trials, assist in the examination of a disorder and related comorbidities, and for the purpose of outcome assessment of interventions. The use of a COS can reduce selective reporting on conditions, inconsistency in clinical use, and variability of reporting across interdisciplinary medical fields that represent CLTs who treat BCRL. The development of a comprehensive COS is intensive; however, the groundwork has been laid by the EDGE Task Force and the Dutch Society of Dermatology in identifying ICF outcome domains and OMs with good psychometrics and clinical utility. Not only is COS a feasible endeavor, but identifying the OMs to measure the COS is certainly within reach, as well as providing guidance as to "when" to measure is also attainable. To that end, this study has identified 15 OMs, which PT and OT CLTs tend to use most often. Most of these trending OMs have been recommended by the EDGE Task Force; however, there are a few that are either not recommended or need further review for BCRL usage COS recommendations.

LIMITATIONS

The convenience sampling method of survey distribution through certification programs resulted in crossover emails from the various institutions and returned a limited response. In addition, the sample size for the analysis ($n = 111$) included a sample of OTs and PTs from the total sample ($n = 130$). These factors limited our ability to generalize the findings to the CLT population consisting of PTs, OTs, MTs, and RNs. The sample appears to be unbiased to the true population as other national and international studies have reported. There is concern that the lack of other professions, practice settings, geographical locations, and the male sex may have limited our understanding of the use of OMs and the predictive contribution that these characteristics provide. The density of CLTs who practice in outpatient clinics may have limited insights into use of OMs in other settings (eg, home health care, long-term care). Future research will need to seek input from respondents who have these characteristics. The survey was lengthy (91 questions) and participants invested a mean of 40.3 minutes to complete, which may have contributed to respondent fatigue, recall bias, and survey completion. The survey question on circumference/volume did not explicitly delineate a separation between circumference and volume but was intended to represent circumferential measurements converted to volumetric measurements to coincide with the Breast Cancer EDGE Task Force CPG circumferential measurement recommendation. It is plausible that respondents may have interpreted this question as being either circumference or volume.

CONCLUSIONS

This study adds to current knowledge by identifying OMs being used by PT and OT CLTs to measure body functions and body structures, and activities and participation compared with what is considered best practice as evidenced in literature. Fifteen OMs used most often on SBC with BCRL were indicated in this study. Outcome measures used most often to assess body functions and structures

exceed those for activities and participation. This study also identifies OMs being used by CLTs with SBC with BCRL needing further investigation. The use of OMs may be influenced by CLT profession, specialization, and level of highest degree. The differences between PT and OT CLTs use of OMs are sporadic and cannot be solely attributed to additional credentialed specializations. In summary, there are differences in the use of OMs depending upon profession, LANA certification, and highest degree earned.

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