JOTE Journal of Occupational Therapy Education

Volume 8 | Issue 2 Article 17

2024

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Abstract

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Keywords

Education, upper limb loss, upper limb difference, curricula, occupational therapy

JOTE
Journal of Occupational Therapy Education

Volume 8, Issue 2

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ABSTRACT

Despite occupational therapy's critical role on the rehabilitation team for individuals with upper limb loss or difference (ULL/D) and prosthetics, this population is not extensively covered in many occupational therapy (OT) program curricula. As such, many clinicians work with patients with ULL/D with little expertise or confidence for this complex population. The aim of this study was to evaluate the OT practitioner experience and practice related to ULL/D and prosthetics in their education and practice. Utilizing snowball sampling, 150 OT practitioners completed a 24-question survey, which assessed OT practitioners' experience with ULL/D, the prosthetic education in their OT program, and their confidence in working with this population. Participants reported they had limited education on this population and would have liked to have more education in school, specifically in the form of active learning opportunities such as hands-on experience with prosthetic devices, observations with clinicians, and discussions with individuals with ULL/D. Recommendations for OT programs include additional active learning opportunities including patient educators and prosthetic simulators, observation opportunities for students interested in working with this population, and continuing education opportunities for OT practitioners after graduation.

Introduction

In the United States, approximately 2 million people are living with limb loss (Amputee Coalition, 2015), with 41,000 (3%) of these individuals experiencing upper limb loss (ULL; Fitzgibbons & Medvedev, 2015). Limb loss refers to when a limb is lost after birth due to events such as vascular complications, diabetes, cancer, severe infections, traumatic accidents, or combat injuries (Johns Hopkins Medicine, n.d). Alternatively, limb difference refers to when a person is born with a limb deficiency or reduction and occurs in approximately 6 per 10,000 live births per year (Le & Scott-Wyard, 2015).

There is also a subpopulation of individuals with bilateral or multiple limb loss that exists and benefits from special considerations from their healthcare providers (Pasquina et al., 2014). While the exact percentage of individuals with bilateral upper limb loss/difference (bilateral ULL/D) in the general population is not recorded, 7% of upper extremity amputations that occurred in active military members were bilateral amputations (Braza & Martin, 2020). Additionally, there has been an increase in B ULL due to a rise in sepsis cases (Rhee & Klompas, 2020; Sears et al., 2022) and a decline in sepsis mortality rates (Rhee & Klompas, 2020), with a resulting amputation of one or multiple limbs as a common attempt to save a patient with sepsis (Sepsis Alliance, 2019).

Both upper and lower limb loss can lead to significant physical and psychological changes that affect occupational performance; additionally, individuals with ULL experience a higher disability rating and greater risk for post-traumatic stress disorder than those with a lower limb loss (Fitzgibbons & Medvedev 2015). Due to the prevalence of psychological and physical challenges after amputation, it is important to understand the unique need for occupational therapy (OT) within this population and to understand the preparedness of OT practitioners to work with this population.

Occupational Therapy and Upper Limb Loss/Difference and Prosthetic Rehabilitation

Due to the broad scope of OT practice which includes both mental and physical health, OT practitioners are well-equipped to work with individuals with ULL/D and prosthetics to address both physical and psychosocial goals (American Occupational Therapy Association [AOTA], 2021). Occupational therapy practitioners should be involved throughout the process of prosthetic fitting and training from before the patient receives a prosthesis, to the discussion on what type of prosthesis will be used, prosthetic training, and finally discharge and community reintegration. In each stage, the OT practitioner will address physical and psychological strengths and barriers to performance (Management of Upper Extremity Amputation Rehabilitation Working Group [MUEARWG], 2022). Throughout this process, the care team including the patient, OT practitioner, and prosthetist work together to determine what type of prosthesis will best fit the patient's needs (Hermansson & Turner, 2017; MUEARWG, 2022). It is crucial for the OT to understand appropriate interventions for a patient prior to receiving a prosthesis and to understand the components and functions of the various types of prostheses in order to be a part of the prosthetic fitting process.

After receiving the final prosthesis, OT sessions will be focused on prosthetic controls training, which will vary depending on the type of prosthesis and incorporating the prosthesis into daily occupations (Atkins, 2016; MUEARWG, 2022; Smurr et al., 2008; Swanson Johnson & Mansfield, 2014). It is crucial for the OT practitioner to be knowledgeable on the prosthetic controls and functions in order to best train and educate the patient as well as communicate challenges and concerns to the prosthetist (Hermansson & Turner, 2017). The patient and the OT practitioner will work on donning and doffing the prosthesis, cleaning and caring for their prosthesis, and learning how to functionally operate the device through controls/prosthetic training (Atkins, 2016; Hermansson & Turner, 2017; MUEARWG, 2022; Smurr et al., 2008). An OT's role in the therapy process and their knowledge of limb loss/difference (LL/D) and prosthetics is crucial as research shows that those who receive OT after prosthesis fitting report their prosthesis to interfere less with their ability to work than those who do not receive OT services. Participating in OT also results in less arm, shoulder, and hand pain in the residual limb as well as lower rates of prosthesis rejection. In comparison with the about 30% of prosthesis rejection rate, participants of the study saw a rejection rate of only 4% (Laurie & Mancinda, 2018).

Occupational therapy practitioners also work with patients to address psychosocial aspects of care (MUERWG, 2022), manage expectations regarding their prosthetic device (Atkins, 2016; Klarich & Brueckner, 2014; MUEARWG, 2022; Swanson Johnson & Mansfield, 2014), and facilitate community reintegration (Smurr et al., 2008; Swanson Johnson & Mansfield, 2014). Individuals who participated in OT had improved psychological outcomes as seen through better total psychosocial adjustment, finding it easier to talk about their limb loss, increased self-efficacy related to work, and improved acceptance of the amputation and prosthesis (Laurie & Mandacina, 2018). Due to the impact of OT on individuals with ULL/D, it is critical that OT practitioners are well-trained to work with this population.

Limb Loss and Prosthetics in Occupational Therapy Education

The Accreditation Council for Occupational Therapy Education (ACOTE) requires entry-level OT education programs "train in the safe and effective use of prosthetic devices" (ACOTE, 2018, p.30). This requirement is an acknowledgment of the important role OT plays in the rehabilitation team for individuals who experience ULL/D. Furthermore, the Occupational Therapy Practice Framework - Fourth Edition (OTPF-4) identified prosthetic care and use as elements of occupations including dressing, personal hygiene and grooming, and personal care device management (AOTA, 2020). The OTPF-4 also listed orthotics and prosthetics as an intervention type under Interventions to Support Occupation (AOTA, 2020). Occupational therapy practitioners are well suited to implement controls training and activity of daily living (ADL) training due to their focus on activity analysis as outlined in the OTPF-4 and in ACOTE standard B.3.6. (ACOTE, 2018; AOTA, 2020). Despite OT's critical role for individuals with ULL/D and the acknowledgment of this role in both the ACOTE standards and the OTPF-4, this population is not significantly covered in many OT program curricula (Mitchell et al., 2014).

Mitchell et al. (2014) surveyed OT directors from 52 OT masters programs inquiring about prosthetic training for both upper and lower limb loss in their curricula and found that 60% of OT programs devote 3-5 hours or less to prosthetic training and only 5% of programs devote 10 or more hours to the population. These results can be compared to the results of MacLeod and Stockert (2021) who surveyed faculty members from 74 accredited physical therapy education programs in the United States. In comparison to OT program curriculum (Mitchell et al., 2014), MacLeod and Stockert (2021) found that 92.3% respondents reported spending 10 or more total hours on amputation rehabilitation and prosthetics education in their curricula. Most OT programs taught this content through lectures and only about half of OT programs utilized hands-on prosthetic use with video and auditory tapes (Mitchell et al., 2014). Additionally, a smaller percentage of OT programs provided students with opportunities such as using a prosthetic simulator, having clinic visits, and having discussions with individuals with ULL (Mitchell et al., 2014). Physical therapy educational programs, on the other hand, reported that 0.5-1 (75%) hour of limb amputation rehabilitation and prosthetic education was completed via classroom lectures and between 0.5-2 (75%) hours were completed via lab. Additionally physical therapy programs identified using simulated (33.4%) or actual (17.6%) patient care experiences. Lastly, 80% of respondents from OT programs said the student experience would be enhanced by additional prosthetic training (Mitchell et al., 2014). The results of Mitchell et al. (2014) demonstrate OT program directors' perspective on the need for increased time spent on prosthetic training in OT curricula. Further, the comparison of the amount and type of education provided in OT programs (Mitchell et al., 2014) versus physical therapy programs (MacLeod & Stockert, 2021) demonstrates the need for increased and improved education on LL/D and prosthetics in OT program curriculum.

While there is current literature that emphasizes the need for additional education on limb loss and prosthetics in OT curricula from the faculty perspective, there is little known about OT practitioners' perceived confidence and preparedness for working with this population and prosthetic devices based on their education. The perspective of OT practitioners provides a unique lens of what strategies and interventions would be most beneficial for students to learn while in school to best maximize their learning and time in the classroom. The objective of this study was to evaluate the OT practitioner experience and practice related to ULL/D and prosthetics and to assess OT practitioners' experience with ULL/D and prosthetic education in their OT program. The study aimed to understand how much and what type of education OT practitioners received on ULL/D and prosthetics in OT school compared to what they felt would have been helpful based on their experience as a practicing OT.

Methods

Research Design

The study employed a non-experimental, descriptive, exploratory design with a survey methodology. The data used for analyses was de-identified, and the study was approved by the associated university's institutional review board as a non-human subjects study.

Measures and Data Collection

Participants of the study were recruited nationally and internationally using snowball sampling via SurveyMonkey® (SurveyMonkey, 2018). The electronic survey was distributed to 600 OT practitioners through recruitment emails that were sent out to colleagues and mentors of the authors, OT department chairs, email distribution lists maintained by the affiliated institution's Department of Occupational Therapy, and OT practitioners from hospitals and clinics across the United States and internationally. A follow-up email was sent out two weeks after the initial email to obtain saturation. The survey was also posted on social media outlets including Facebook groups and OT forums. Participants were encouraged to share the survey with other OT practitioners and the survey was open for four weeks. Inclusion criteria include identifying as a fluent English speaker, being over the age of 18, being a licensed and/or registered OT, and graduating from an OT bachelor's, master's, or doctorate program.

Instrument

A 24-question online survey was designed to assess participants' experience with ULL/D and prosthetics as an OT practitioner and in their OT education. Prior to distribution, the survey was pilot tested by content experts in both education and ULL/D and prosthetics to ensure reliability and validity. The assessment of reliability focused on internal consistency, which measures the extent to which the survey items are interrelated. Validity was measured by completing pilot testing that aimed to evaluate both content validity and construct validity. Content validity was ensured by involving domain experts who reviewed the survey items for relevance, clarity, and comprehensiveness. Construct validity was assessed by examining the relationships between the survey items and relevant theoretical constructs. Experts in survey design, limb loss and physical rehabilitation participated in the pilot testing of the survey and facilitated the development of the final survey used in this study. Participants first answered three screener questions to ensure that they met the inclusion criteria of the survey and then answered five demographic questions.

Participants were asked to report the number of hours spent on LL/D and prosthetics, the levels of LL/D covered, the type of education they received, and the types of prosthetics covered in the curriculum. Participants were also asked about their experience working with this population including how many individuals with unilateral ULL/D, bilateral ULL/D, and multiple limb loss or differences (MLL/D) as well as in which setting they treated these individuals. They were asked to report their confidence in treating individuals with each type of limb loss and prosthetic device. Participants reported if they would have liked to receive more education on LL/D and prosthetics in their OT program and if so, what type of education. Participants also reported if their place of work offers continuing education on ULL/D and prosthetics. The survey included multiple choice, select all that apply, yes/no, and 5- Point Likert-scale questions. The data from the survey was collected anonymously using a SurveyMonkey® survey (SurveyMonkey, 2018).

Data Analysis

Incomplete survey results were excluded from the data analysis. Descriptive statistics including frequencies and percentages were collected and analyzed from both the demographic and survey data using SurveyMonkey and IBM SPSS Statistics (IBM, v22).

Results

Participants

A total of 204 people opened the survey, with 159 completing the survey. Nine individuals did not meet the inclusion criteria; therefore 150 individuals completed the entire survey. Of the 600 recruitment emails sent out, there was a 25% return rate (n=150). Years of experience ranged from 0-11 months to more than 20 years. Participants of the survey worked in a wide range of practice settings with the most common settings including adult outpatient (24.00%, n=36), outpatient hand therapy (21.33%, n=32), adult acute care (20.67%. n=31), adult acute inpatient rehabilitation (20.00%, n=30), and outpatient pediatrics (14.00%, n=21). Of note, more than half of participants attended school in the Midwest and currently practice in the Midwest, likely due to the authors living in the Midwest. 15 participants reported receiving two or more OT degrees. Additionally, 20 participants reported going to school and practicing outside of the U.S. including Germany (1), Canada (5), the United Kingdom (2), Austria (1), Australia (5), Japan (3), the Netherlands (1), and Sweden (2). Full demographic information of the survey participants can be found in Table 1.\

Clinical Experience with Upper Limb Loss and Prosthetics

Participants of the survey reported the number of patients they worked with that had unilateral ULL/D, bilateral ULL/D, and multiple LL/D. Of the 150 respondents, 86% (n=129) had worked with at least one patient with unilateral ULL/D. Further, 59.33% (n=89) of participants had worked with at least one individual with bilateral ULL/D and multiple LL/D. The most common settings in which OT practitioners had treated this population were adult acute inpatient rehabilitation (31.33% , n=47), adult outpatient (26.67%, n=40), adult acute care (23.33%, n=35), outpatient hand therapy (20.67%, n=31), and outpatient pediatrics (13.33%, n=20).

Table 1

Participant Demographics and Clinical Experience

Variable	n	%	Variable	n	%
Years of Experience			Patients with unilateral ULL/D		
0-11 Months	7	4.67	0	21	14.00
1-2 Years	13	8.67	1-2	26	17.33
3-5 Years	26	17.33	3-5	23	15.33
6-10 Years	33	22.00	6-10	12	8.00
11-15 Years	20	13.33	More than 10	68	45.33
16-20 Years	10	6.67			
20+ Years	41	27.33			
Location of OT school			Patients with bilateral ULL/D		
Northeast	25	16.67	0	61	40.67
Southwest	3	2.00	1-2	26	17.33
West	5	3.33	3-5	17	11.33
Southeast	8	5.33	6-10	17	11.33
Midwest	89	59.33	More than 10	29	19.33
Outside of the US	20	13.33			
Location of practice			Patients with multiple LL/D		
Northeast	14	9.33	0	67	44.67
Southwest	2	1.33	1-2	22	14.67
West	11	7.33	3-5	22	14.67
Southeast	21	14.00	6-10	17	11.33
Midwest	81	54.00	More than 10	22	14.67
Outside of the US	21	14.00			
Type of OT education					
Bachelor’s	40	26.67			
Masters	95	63.33			
Entry-Level Doctorate	22	14.67			
Post- Professional Doctorate	12	8.00			

Education on Limb Loss and Prosthetics

Participants reported on the number of hours spent on LL/D, the amount of time specifically spent on ULL/D, the types of prostheses covered in their curriculum, and the types of limb loss covered in their curriculum. Of the 150 participants, 11.33% (n=17) reported they did not receive any education on this population and 84.66% (n=127) of respondents received less than six hours of education in OT school. Only 32% (n=48) and 28% (n=42) of respondents reported learning about bilateral ULL/D and multiple LL/D respectively. The time spent on this population in OT curriculum mostly consisted of lectures (84.67%, n=127)) and workshops/labs (30.67%, n=46). Curricula most commonly included education on body-powered prostheses, with less than half of respondents having received education on powered/myoelectric or passive/activity specific and a quarter not receiving any education on prosthetic devices. Full data on education on LL/D and prosthetics in OT program curricula can be found in Table 2 and Figure 1.

Table 2

Education on Limb Loss/Difference and Prosthetics in OT Program Curricula

Variable	n	%	Variable	n	%
Hours of Education on LL/D			Hours Specifically on ULL/D		
None	17	11.33	None	25	16.67
1-2 Hours	65	43.33	1-2 Hours	73	48.67
3-5 Hours	45	30.00	3-5 Hours	38	25.33
6-8 Hours	15	10.00	6-8 Hours	8	5.33
9-10 Hours	2	1.33	9-10 Hours	4	2.67
10+ hours	6	4.00	10+ Hours	2	1.33
Program Focus on Upper, Lower, or Both			Prosthetic Devices Covered in OT Curriculum		
Upper	42	28.00	Body-Powered	97	64.67
Lower	12	8.00	Powered or Myoelectric	65	43.33
Both	68	45.33	Passive or Activity Specific	61	40.67
None	28	18.67	None	37	24.67

Confidence Working with Upper Limb Loss/Difference and Prosthetics

Participants reported their confidence working with individuals with unilateral ULL/D, bilateral ULL/D, and MLL/D as well as their confidence treating an individual with a body-powered, powered/myoelectric, or passive/activity specific myoelectric device. Their confidence was rated on a 5-point Likert Scale. Participants felt most confident working with individuals with unilateral ULL/D with 74.49% (n=111) agreeing or strongly agreeing that they felt confident working with these individuals. Less than half of the participants agreed or strongly agreed they were comfortable working with individuals with multiple LL/D, powered or myoelectric devices, and passive/activity-specific devices. Results are represented in Table 3.

Table 3

Perceived Confidence Working with Individuals with Upper Limb Loss/Difference and Prosthetics

	Percent of Respondents				
	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
Body-Powered Prostheses	14.77	21.48	16.11	22.82	24.83
Powered/Myoelectric Prostheses	18.00	27.33	13.33	17.33	24.00
Passive/Activity Specific Prostheses	12.75	22.15	18.12	22.82	24.16
Unilateral ULL/D	5.37	10.07	10.07	36.91	37.58
Bilateral ULL/D	12.00	16.00	19.33	30.00	22.67
Multiple LL/D	12.67	22.00	16.67	26.57	22.00

Additional Education

Participants were asked if they would have liked to receive more education on unilateral ULL/D, bilateral ULL/D, and multiple LL/D, as well as the three types of prosthetic devices. When adding agree and strongly agree responses, results of the survey demonstrate that 78.67% (n=118) of participants would have liked to have more education on unilateral ULL/D, 80% (n=120) for bilateral ULL/D, 77.18% (n=116)for multiple LL/D, 77.86% (n=117)on body-powered prostheses, 78.00% (n=117) on powered/myoelectric prostheses, and 76.67% (n=115)on passive/activity specific prostheses. Full results are found in Table 4.

Table 4

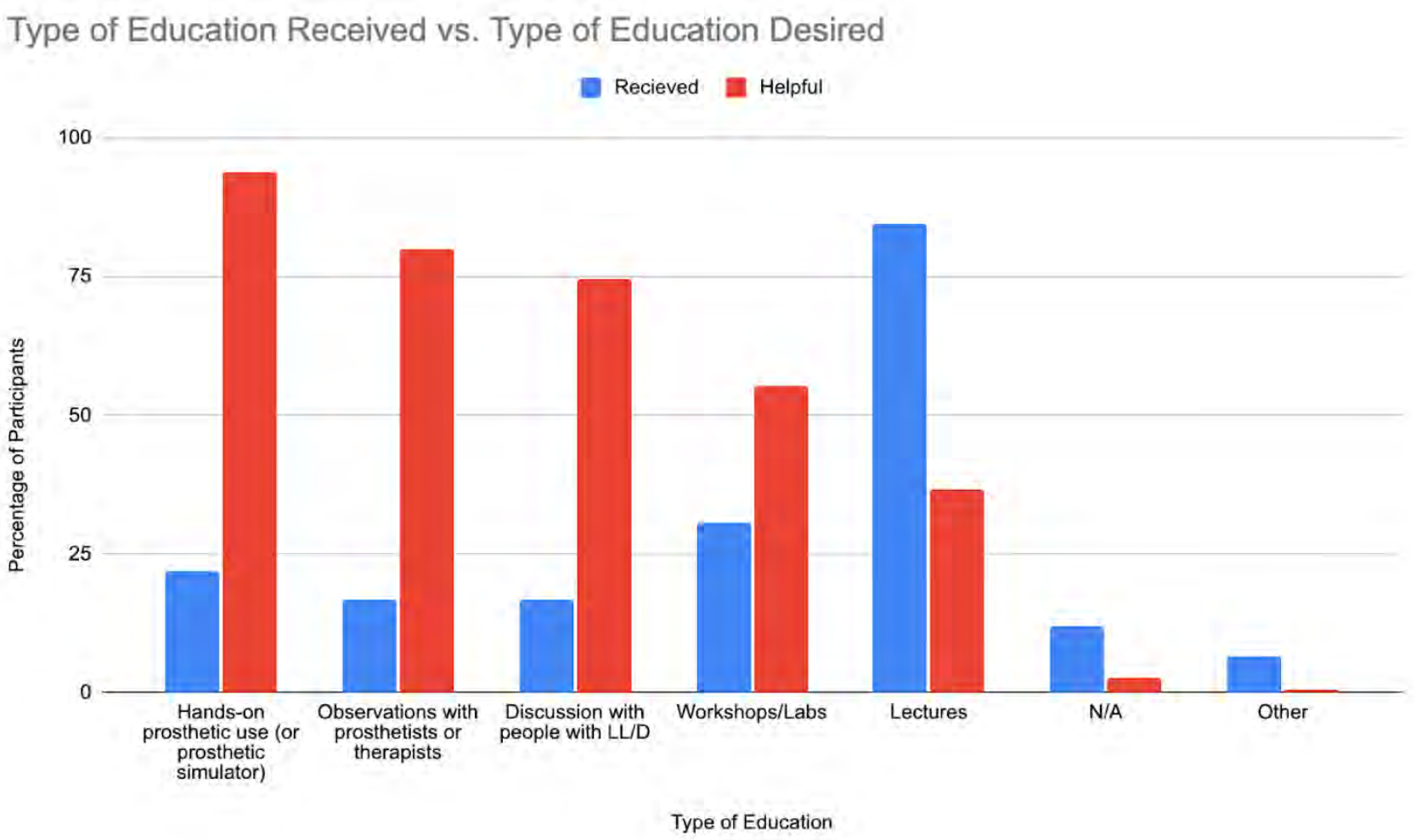
Topics in Education to Receive Additional Information

	Percent of Respondents				
	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
Body-Powered Prostheses	2.68	3.36	16.11	44.97	32.89
Powered/Myoelectric Prostheses	2.00	4.00	16.00	44.67	33.33
Passive/Activity Specific Prostheses	2.00	4.00	17.33	44.00	32.67
unilateral ULL/D	2.67	1.33	17.33	42.67	36.00
bilateral ULL/D	2.00	1.33	16.67	43.33	36.67
Multiple LL/D	2.01	2.68	18.12	40.27	36.91

Participants further indicated what type of education would have been helpful to prepare them for treating this population. Participants responded that hands-on practice with prosthetic devices/simulators (94%, n=141), observation with prosthetists or therapists (80%, n=120), and discussions with people with LL/D (74.67%, n=112) would be the most helpful to prepare for clinical experience. Additionally, only 36.67% (n=55) of participants reported that lectures would be most helpful for preparing to treat this population. Figure 1 indicates the differences between the type of education participants received compared to the type of education they felt would have been most helpful to prepare for working with this population. Participants were also asked if their place of work offered continuing education courses on ULL/D and prosthetics. Results showed that 34% (n=34) had access and 66% (n=99) did not have access to these continuing education courses.

Figure 1

Type of Education Received vs. Type of Education Desired



Discussion

The aim of this study was to evaluate the OT practitioner experience and practice related to ULL/D and prosthetics and to assess OT practitioners' experience with ULL/D and prosthetic education in their OT program. This is the first known study to assess the amount and type of education on ULL/D and prosthetics provided and desired in OT program curricula from the OT practitioner perspective. Results of this study can initiate conversations among stakeholders, including OT faculty and OT practitioners, on the type and amount of education taught on this population. The results of this survey are increasingly relevant to OT curricula due to the increase in individuals with bilateral ULL/D and LL/D.

The participants of the survey represented a wide range of OT practitioners with a variety of experience, education, place of work, clinical practice area, and experience with individuals with ULL/D and prosthetics. Participants of this study were more likely to have worked with patients with unilateral ULL/D than bilateral ULL/D or multiple LL/D. This is consistent with the demographics of the limb loss population, with unilateral ULL being more common (Braza & Martin, 2020). Additionally, the most common settings in which OT practitioners have treated individuals with ULL/D align with the continuum of care for this population including an acute care hospital stay after surgery (MUEARWG, 2022), acute inpatient rehabilitation, and outpatient therapy (Atkins, 2016; MUEARWG, 2022; Smurr et al., 2008).

Participants rated their confidence in working with individuals with varying levels of limb loss and a variety of prosthetic devices. Participants report being the most confident working with individuals with unilateral ULL/D, aligning with the results that show that practitioners have the most experience working with those that have unilateral ULL/D. For multiple LL/D and types of prosthetic devices, however, less than half of participants report that they feel confident in their abilities to treat. While this difference is reflected in the amount of experience practitioners have with bilateral ULL/D and multiple LL/D, it is also important to examine ACOTE standards, guidelines of the OTPF-4, the amount and type of education practitioners receive, and the amount and type of education they feel would have been helpful to prepare them for clinical practice. This will help to understand if OT curricula are able to better prepare OT practitioners to work with individuals with ULL/D and prosthetics.

ACOTE standard B.4.12. outlined that OT programs should prepare students to work with prosthetic devices and prosthetic wear and care are outlined as occupations in the OTPF-4 (ACOTE, 2018; AOTA, 2020). However, the results of this survey showed that 11.33% (n=17) of participants did not recall receiving any education on ULL/D and 24.67% (n=37) did not recall receiving any education on prosthetic devices. Some of this can be accounted for in revisions and additions to the ACOTE standards and OTPF-4 since some of the OT practitioners may have graduated. Eighty-four percent (n=126) of respondents reported receiving less than six hours of education in this population. This was consistent with the findings from Mitchell et al. (2014) in which 60% (n=90) of OT program directors reported their programs spent only three to five hours on prosthetic training. Results of this survey demonstrated that over 75% (n>112)

of OT practitioners would like to have more education on ULL/D and prosthetics and less than 7% (n<11) reported that additional information would not have been helpful. One explanation for the difference is that those who did not want additional education worked in a setting in which they did not treat this population.

Discrepancies were found in analyzing the type of education received and the type of education respondents felt would have been helpful. Overall, participants reported wanting additional active learning opportunities, putting less emphasis on the need for additional lectures. These results aligned with current literature on the positive impacts of active learning on student performance and experience. Miller and Metz (2014) demonstrated that while physiology faculty members relied heavily on lectures in their teaching, students reported learning best through activities. Additionally, active learning, especially in classes smaller than 50, has been shown to increase exam scores for students (Freeman et al., 2014). Lectures are the only type of education that respondents wanted less of than what they received.

Examples of active learning that respondents reported would be helpful in their education were prosthetic simulators and discussions with people with LL/D and prosthetics, also known as patient educators. Mitchell et al. (2014) discussed that adding prosthetic simulators to OT programs would be useful in educating students. Students would be taught the basic operations during school workshops and then be able to “check out” the simulator for at-home use. The authors discussed the limitation of this addition was that there were not any prosthetic simulators readily available at the time for OT programs. However, the company Fillauer TRS Prosthetics (n.d.) currently has a body-powered prosthetic simulator that is commercially available for clinics, universities, and institutions. This device has been designed to teach those without LL/D, including students, clinicians, and family members, how to operate a body-powered prosthetic device (TRS Prosthetics, n.d.) and could be a beneficial addition to OT curricula. Additionally, patient educator experiences in OT programs have been shown to have lasting effects on clinical reasoning, self-awareness, confidence, and empathy in their Level II fieldwork placements (Hedge et al., 2015). Studies also show that learning from patients can improve students’ knowledge and attitudes towards conditions as well as communication with patients and patient-centered care (Gordon et al., 2019). Patient educators also benefit from these experiences reporting opportunities to guide the next generation, personal growth and reflection, and increased self-efficacy (Kline et al., 2022). This mutually beneficial form of education can increase knowledge of LL/D and prosthetics in OT students.

Despite the benefits of active learning and the results of this survey demonstrating OT practitioners’ belief that active learning would have been helpful in their education, both students and faculty reported that barriers to active learning included a lack of time and comfort with traditional lectures (Miller & Metz, 2014). Results of this study showed that OT practitioners also wanted more time spent on all topics related to ULL/D and prosthetics. This was likely due to a lack of confidence in working with individuals with

ULL/D and training individuals on how to use a prosthetic device. Mitchell et al. (2014) reported the greatest barriers to providing more education on this population were lack of time and overcrowding of the curriculum.

One way to combat the barrier of time is to adopt a flipped classroom. In a flipped classroom content that is typically provided in the classroom such as lecture content, is provided to complete at home. This allows class time to be centered on the student's needs through hands-on activities, discussions, and answering student questions (Akçayır & Akçayır, 2018). Studies show improved learner performance, enhanced student satisfaction, and increased levels of engagement (Akçayır & Akçayır, 2018). A flipped classroom could maximize the time that is able to be allotted to ULL/D and prosthetics in OT curricula.

Implications for Occupational Therapy Education

Students benefit from active learning methodology and OT practitioners report the need for additional education on ULL/D and prosthetics. It is recommended that OT faculty consider opportunities to provide additional in-class active learning opportunities to supplement lecture content specific to this population. Authors acknowledge the time constraints associated with OT curricula based on the ACOTE standards and need to train entry-level practitioners. Therefore, a flipped classroom methodology is recommended to maximize in-class time and complete learning opportunities perceived as most helpful, such as active learning, in the classroom. Two recommended active learning opportunities are patient educators and hands-on practice with prosthetic simulators. In addition, supplemental opportunities can be provided for students who have an interest in this population including setting up observation or fieldwork experiences with OT practitioners who work with this population and resources for continuing education courses. Occupational therapy practitioners should also seek continuing education to increase confidence in working with this population after graduation. Implications for further research include examining the impact of active learning opportunities for ULL/D and prosthetic education in OT education programs.

Limitations

There were several limitations of this study. One limitation is that the survey used was created by the authors. The survey was tested by experts in education and ULL/D and prosthetics to establish validity to address this limitation. Another limitation is that while the study has national and international representation, most respondents went to school and practiced in the Midwest of the United States due to the location and contacts of the authors. International participation may also have impacted the results of the study as different countries have different academic standards relating to LL/D and prosthetics education and as the study was anonymous, the results are not able to be separated by country. Additionally, ACOTE standards have changed over the past 20 years, which may have impacted the amount and type of education provided for those who are not recent graduates of OT school. Lastly, this survey asked for the specific amount of hours spent on one topic in their OT education and it is possible that not all

respondents were able to accurately recall how many hours were spent on this population depending on when they attended OT school, especially those who attended OT school over 20 years ago, which may have resulted in recall bias.

Conclusion

Occupational therapy practitioners are key members of the rehabilitation team for individuals with ULL/D prosthetics. However, current OT curricula do not have extensive education or ample active learning opportunities in this complex population, which limits OT practitioners' knowledge and confidence in working with ULL/D and prosthetics. This study demonstrates the need for additional education and modifications in the type of education provided on ULL/D and prosthetics in OT graduate programs. Active learning, possible through flipped classroom methodology as well as supplemental learning opportunities is recommended to allow for increased education in this population. Occupational therapy practitioners should also seek out continuing education opportunities to increase knowledge about working with this population. These recommendations have the potential to increase OT practitioners' confidence in working with individuals with upper limb loss/difference and prosthetics.

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