Orthotics and Prosthetics

Activity for 2019

Activity No: OS5 (19) 2023

Article

Orthotics and Prosthetics: Outcome studies

Approved for **THREE (3)** Clinical Continuing Educational Units (CEU's)

The Rockers of Gait: A Need for Debate?

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INTRODUCTION

The term rocker is commonly used in descriptions of gait. However, there is some confusion as to what a rocker is, where the divisions between rockers occur, the kinematics and muscle actions of each rocker, and the terminology used to describe them (Owen, 2016). Perry first described the rockers of gait, attributing the purpose as production of "tibial advancement" during stance, an essential element in forward progression (Perry, 1974, 2010). She included joints, segments, and muscle actions in her model. More recently, the rockers have been reinterpreted as solely relating to ankle kinematics, which does not recognize essential components of Perry's model, including other joints and segments. A definition and comprehensive description of the rockers is required.

METHOD AND RESULTS

Tabulation of available evidence and video vector gait laboratory data (Table 1).

DISCUSSION

Confining interpretation of the rockers to ankle kinematics does not recognize: (1) the original purpose of describing the rockers, which is to describe the pivot mechanisms by which normal shank kinematic is produced; (2) the original differentiation between 2nd and 3rd rocker, heel rise at 30 percent gait cycle (GC). the start of terminal stance test (TST), the pivot transferring from the ankle to the forefoot. More recent descriptions differentiate these rockers by the point at which the ankle movement changes direction, at 45 percent GC, which does not coincide with heel rise; (3) four events of ankle kinematics in stance phase. In TST, the ankle is quasistiff in dorsiflexion, the stiffness of the ankle is essential for heel rise, and the ability to achieve maximum knee extension at 40 percent GC, maximum hip extension at 50 percent GC. Such omissions may lead to suboptimal interventions.

CONCLUSION

A definition of the rockers of gait is proposed: The mechanisms of the ankle and foot that produce shank kinematics during stance phase. A four-event model that includes both segment and joint kinematics, pivots, and muscle actions is proposed.

CLINICAL APPLICATIONS

Clear understanding of the mechanics of normal gait is crucial to O&P practice and rehabilitation.

REFERENCES

Owen E. *Physical Therapy for CP* 2016:287–314.
Perry J. *Clin Orthop Rel Res* 1974.
Perry J. *Gait Analysis* 2010:33–35.

Table 1

	1st Rocker	2nd Rocker	3rd Rocker	4th Rocker
% Gait Cycle	0-10% GC	10-30% GC	30-50% GC	50-60 % GC
Subdivision PERRY TERMINOLOGY	Loading Response	Mid Stance	Terminal Stance	Pre-Swing
Support	Double Support	Single Support	Single Support	Double Support
Pivot	Heel	Ankle Joint	Forefoot, MT Head	Forefoot, MTP Joint
Shank Kinematics	20° Recline to 5° Recline	5° Recline to 10° Incline	10° Incline to 25° Incline	25° Incline to 50° Incline
Ankle Kinematics	Plantigrade to 5° Plantar Flexion	5° Plantarflexion to 10° Dorsiflexion	10° to 12° to 7° Dorsiflexion	7° Dorsiflex to 20° Plantar Flexion
Foot Kinematics	20° Toe Up to Horizontal	Horizontal	Horizontal to 20° Heel Up	20° Heel Up to 60° Heel Up
MTPJTs Kinematics	25° Extension to 0°	0° to 0°	0° to 25° Extension	25° Extension to 55°Extension
MUSCLE ACTIONS	Dorsiflexors act to control the rate of foot-to-floor and ankle plantarflexion, also to pull the shank to a less reclined alignment	Plantar flexors act to control ankle dorsiflexion and shank inclination, angular velocity reducing, at 30% shank is "virtually stationary"	Plantar flexors act to make the ankle joint "quasi-stiff" or "virtually locked," which causes the heel to rise	Plantar flexors act to rapidly move the ankle joint from dorsiflexion to plantarflexion and create further heel rise
	Eccentric Dorsiflexors	Eccentric Plantar Flexors	30-45% GC Eccentric Plantar Flexors 45-50% GC Concentric plantarflexors	(a) Concentric Plantar Flexors or (b) Spring Action by Tendon

Developing a Competence-Based P&O Core Curriculum: A Delphi Study

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INTRODUCTION

Over the past decade, university curricula have been transitioning from a subject or discipline-based approach to competence-based approach. The competence-based approach focuses upon outcomes that are most relevant to employers and should be based on knowledge of the competence needed for professional activities. (Edgren, 2006). A number of competency standards for the prosthetics and orthotics (P&O) profession have been proposed by professional organizations worldwide. To date, there is no international consensus regarding core competencies. The aim of this study was to determine the necessary competences for entry into the P&O profession in Sweden and to use these suggested competences to develop a core curriculum.

METHOD

The Delphi technique was used to obtain consensus regarding core competencies for entry-level clinicians. Three Delphi rounds were completed over a six-month period (Figure 1). In the first phase, two focus groups were held with the aim of reviewing existing P&O competency documents and identifying areas relevant to the Swedish workforce. Based on results of the focus groups, the first round of Delphi statements was generated and distributed as a questionnaire to an expert panel consisting of 40 individuals. Experts were requested to grade the importance of various entry-level competencies on a 5-point Likert scale and comment when they felt necessary. Seventy-five percent agreement was chosen as the consensus level. In the second round, experts were provided with feedback related to round one, and modifications were made to questions where there was misunderstanding or clarification was required. In the final round, competencies upon which agreement was reached were sent to the expert panel and comments were invited.

RESULTS

Thirty-five experts responded to the Delphi questionnaires. Consensus was reached on competence standards falling under four main areas of practice: (1) multidisciplinary practice; (2) provision of clinical care; (3) P&O services and products; and (4) professional values. There were a number of competencies that experts considered important for professional practice but not necessary for entry-level clinicians. These included issues related to billing and service provision that are under the control of regional government and could differ between municipalities, but also involved taking leadership roles within organizations.

Results of the Delphi analysis have been used to develop a new undergraduate curriculum for P&O in Sweden.

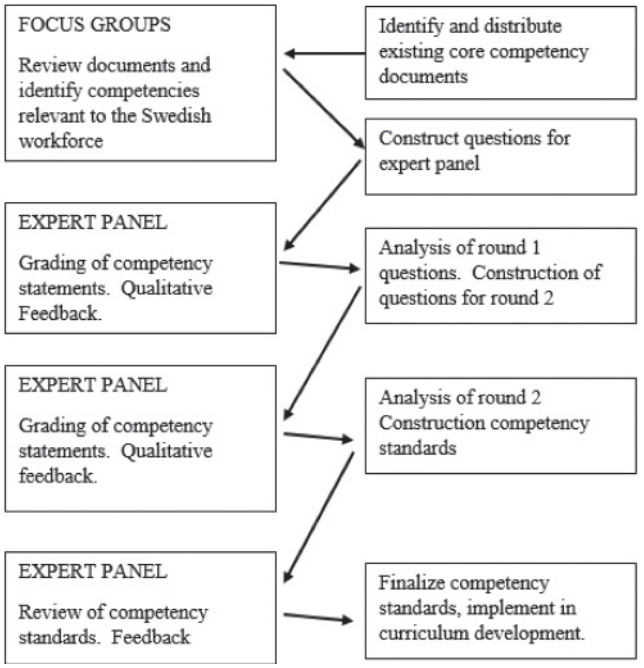

Figure 1. Overview of the Delphi process.

DISCUSSION

As the P&O profession develops, it is vital that the core curriculum meets the current and changing needs of the workforce. The Delphi technique has been used to facilitate curriculum development in other health professions (Edgren, 2006) and provides a means by which consensus can be reached regarding core competencies required of graduates. Competencies identified in the present study are consistent with those reported in an Australian study (Ash et al., 2015), suggesting that professional activities in Sweden and Australia are relatively similar.

CONCLUSION

This study used a Delphi method to identify core competencies of entry-level P&Os in Sweden. Results were used to develop evidence-based core curriculum for undergraduate education at Jönköping University.

CLINICAL APPLICATIONS

The Delphi technique can be used to facilitate evidence-based curriculum development that addresses current and future needs of the P&O profession.

REFERENCES

AshH S, et al. *Int J Evidence-Based Healthcare* 2015;13:93–103.
Edgren G. *Medical Teacher* 2006;28:409–17.

Entrustment Trends in Orthotics and Prosthetics Clinical Residency: A Preliminary Report

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INTRODUCTION

Orthotic and prosthetic (O&P) residency mentors have little guidance transitioning residents between observing and performing patient care. This study aims to identify entrustment trends and their determining factors within O&P residencies in order to establish a baseline for measuring student progress toward delivering independent patient care.

METHOD

All preceptors under the National Commission of Orthotic and Prosthetic Education (NCOPE) were invited to participate in a 26-question online questionnaire that examined possible entrustment factors. For residency characteristics, preceptors reported the length of managed residency (12-month, 18-month, or a portion of 12- or 18-month residency), and if their residents focused on orthotics (O), prosthetics (P), or O&P. For resident characteristics, they rank ordered several general skills (interpersonal skills, self-awareness, evaluation skills, knowledge and plan formulation, technical skills) from most to least impactful on entrustment decision-making and selected the top three behavioral traits that promote entrustment (competence, reliability, honesty, recognition of limitations/willingness to ask for help, empathy/openness/receptiveness toward patients, interprofessional communication skills, self-confidence, self-evaluation/reflection/development, sense of responsibility, ability to effectively address mistakes). Preceptors reported at what time during residency they start entrusting residents with clinical tasks within the American Board for Certification in Orthotics, Prosthetics & Pedorthics (ABC) essential-to-practice domains (patient assessment, formulation of treatment plan, implementation of treatment plan, follow up to treatment plan, documentation, practice management, and promotion of competency/enhancement of professional practice) with direct and indirect supervision. The data was analyzed with Microsoft Excel 2011 and SPSS Version 23 (IBM, Chicago, IL) to produce descriptive statistics and correlations.

RESULTS

Seventy-seven of 875 (9%) candidates completed the survey. Fifty-five preceptors (71%) oversee a 12-month residency, 15 preceptors (20%) oversee an 18-month residency, and 20 preceptors (26%) oversee a rotation (some preceptors oversee multiple residencies of different lengths), while 15 preceptors (20%) oversee O residents only, 15 preceptors (20%) oversee P residents only, and 47 (61%) preceptors oversee O&P residents. The older the respondent, the more likely the respondent reported educating residents in practice management and documentation ($p<0.05$). Female respondents were more likely to indicate they spend more time educating residents in patient assessment and promotion of competency/enhancement of professional practice ($p<0.05$). The top three behavioral qualities impacting entrustment include recognition of limitations and willingness to ask for help (45), competence (37) and self-evaluation, reflection, and development (27). Preceptors ranked evaluation (27) as the most impactful among the five general skills on entrusting tasks, and technical skills as the least impactful (4). Considering trends across ABC practice domains, preceptors of 12-month residency programs entrust residents to independently perform (indirect supervision) when they have completed approximately 75 percent (i.e., 9 months) of the program. Preceptors of 18-month residents entrust their residents by the time they reach 50 percent (i.e., 9 months) of training. Some (19) residency preceptors never allow a resident to independently perform practice management during residency.

DISCUSSION

Many healthcare professions have documented entrustable practice areas in order to direct supervisors in clinical education, and O&P clinical educators may benefit from their own professional guidelines and standards in entrustment practices. These data highlight important behavioral qualities and developmental skills as entrustment indicators and provide possible timelines for the entrustment of responsibilities to residents.

CONCLUSION

Residency supervisors may find this information useful in entrustment decision-making, and residents may be able to hone behavioral and clinical skills in order to ensure progress toward providing independent patient care.

CLINICAL APPLICATIONS

This study presents descriptions and trends in O&P clinical education, which can directly impact current and future patient care.

The Baylor College of Medicine Residency Model: Description, Reflection, and Progress

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INTRODUCTION

Clinical education in orthotics and prosthetics (O&P), while based upon the graduate medical education model, has historically taken place outside of direct academic oversight. The Baylor College of Medicine Orthotics and Prosthetics (BCM O&P) Program is the first accredited O&P education program to include the clinical residency within the degree plan. The primary objective of the study was to describe and quantify the BCM O&P Program clinical residency experience. The secondary objective was to use clinical experience data to improve the clinical education curriculum.

METHOD

The researcher examined data from the logged cases of three cohorts of students (n=56) who have utilized the Typhon logging database (Typhon Group, Metairie, LA) for 18-month O&P residencies involving clinical rotations at up to six clinical sites. Descriptive statistics (mean, range, and standard deviation) and correlations were calculated for characteristics of case logs, including total patient encounters, types of patient encounters, quantity of encounters directly related to National Commission on Orthotic and Prosthetic Education (NCOPE) clinical residency competencies, and level of independence in patient encounters. Data was analyzed through SPSS Version 23.0 (IBM, Chicago, IL).

RESULTS

Data from only two cohorts (n=36) is currently available. Additional data and analysis will be presented at the time of the presentation. Preliminary analysis revealed the total number of cases residents logged ranged from 239 to 1,299 (mean=802.4, SD=301.5). On average, over half of the cases a resident logged were identified as being performed independently (420 cases out of 800 total). Descriptive statics for encounters residents logged as performed in categories specific to NCOPE competencies are outlined in Figure 1.

Performance-Level Encounters Logged (N=37)		
	Mean	**SD**
Transfemoral Prosthesis	42.0	31.8
Transtibial Prosthesis	97.9	59.9
Upper-Limb Prosthesis	8.9	13.2
Partial Foot/Symes Prosthesis	14.2	10.8
Postoperative Care	3.9	5.3
Foot Orthosis	31.8	40.4
Ankle Foot Orthosis	113.2	67.3
Knee Ankle Foot Orthosis	6.1	6.2
Knee Orthosis	18.4	14.9
Scoliosis Orthosis	5.9	8.2
Thoracolumbosacral Orthosis	11.8	14.0
Upper-Limb Orthosis	13.2	11.9

Figure 1. Mean number of cases logged as performed according to classification of devices required for NCOPE competencies.

Residents were significantly more likely to log procedures as independently performed if they logged more cases involving transfemoral or transtibial prostheses, upper-limb prostheses, foot orthoses, knee orthoses, thoracolumbosacral orthoses, scoliosis orthoses, or more total cases. In order to collect clinical data that reflected the experiences of residents, additional clinical curriculum involving weekly review of case logs was implemented.

DISCUSSION

The BCM O&P clinical rotation residency model allows for extensive exposure to a variety of clinic settings and patients. However, the wide range of quantities and types of cases logged by residents presents both an advantage to the clinical rotation model and an opportunity for additional instruction in order to ensure accuracy and establish standards. The adoption of revised clinical requirements may improve case log accuracy, set expectations for future residents, and allow clinical educators from various rotations to examine the progression of the resident's experience.

CONCLUSION

This study represents the beginning of an effort to establish normative data and best practices for O&P clinical education. Additional research is needed to examine factors in clinical education that predict resident success.

CLINICAL APPLICATIONS

Review of educational programs is necessary to ensure educators are effectively preparing clinicians for contemporary practice, thereby improving the quality of patient care.

Experience Integrating Outcome Measures in Routine O&P Practice

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INTRODUCTION

Outcome measures (OMs) are increasingly used by prosthetists and orthotists. Between 38 percent and 69 percent of prosthetists report utilizing OMs (Gaunaurd, 2015; Borrenpohl, 2016) but how consistently prosthetist systematically perform an OM is not known. Barriers to adoption of OMs are well known (e.g., time, resources, expertise, etc.), but solutions for successful integration of OMs in routine clinical practice are still needed.

This presentation will identify administrative, practical, and technical obstacles, and review steps taken at a multicenter private orthotics and prosthetics (O&P) practice to improve utility and utilization of OMs in treatment plans, outcome monitoring and continuous quality improvement (CQI) activities.

METHOD

With support from administrative leadership, a practitioner-lead effort selected an OM instrument battery for common patient device types (lower-limb prostheses (LLP) and lower-limb orthoses (LLO)). Current staff and new hires received OM education and training on the specific OM instruments in the battery. Performance reviews were performed by querying patient OM scores from the EMR system (OPIE Software, Gainesville, FL) calculating the percent of patients receiving LLP or LLO devices with OMs in their chart and benchmarking these among practice locations and against organization-wide goals. Individual barriers or burdens were addressed, and expert support was provided when necessary.

To increase performance, the utility of the OM data collection to the individual practitioner and patient was enhanced in several ways. A web-based OM collection and aggregation system was developed using the HIPPA-compliant cloud version of Microsoft Excel. This allowed OM administration to be completed with iPad tablets implemented across the practices. A digital report format was created including graphical representation of current and past patient OM scores, automated interpretation, comparisons against published reference scores, and a place for practitioners to write in OM summaries.

RESULTS

All nine practice locations adopted the OM battery simultaneously, while performance (percent OM in patient chart) varied across individual practitioners and practice locations. Trends of low OM reporting percentages were noted with newly hired practitioners and in offices with higher patient loads. When the new web-based OM administration and automated report formatting was adopted, OM percentage performance increased.

Figure 1 shows the increase in utilization across all offices once the new system was adopted for Q2 of 2017. A total of 870 Amputee Mobility Predictor, 363 Prosthesis Evaluation Questionnaire, 872 Timed Up and Go, and 732 Activity Specific Balance Confidence scores were recorded in the combined database.

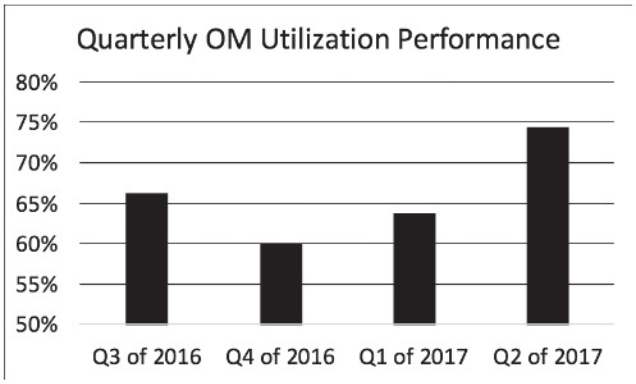

Figure 1. Outcome Measure performance per annual quarter by percentage OM documented for every lower-limb prosthesis provided to a patient.

DISCUSSION

The OM data aggregated across all practice locations provides a unique perspective of patient outcomes, and the data set has been accessed for IRB-approved retrospective chart reviews on amputee mobility (Kaluf, 2014; Dillon, 2017). While 100 percent of practice locations and O&P practitioners had adopted an OM battery as routine practice, OM performance reviews showed continued barriers in utilization.

Developing a web-based OM platform with iPads improved the accessibility and efficiency of administration and collection. An automated OM report format with score interpretation increased the relevance of the OM data for each patient encounter. Together these increased the utility of the OM battery and improved the OM performance.

CONCLUSION AND CLINICAL APPLICATIONS

By addressing barriers to adoption, the experience from Ability Prosthetics & Orthotics demonstrates feasibility of administering OMs in routine clinical practice, interpreting scores for more informed clinical decisions, and using OMs as a CQI activity. The approach and experience presented here can inform best practices, and performance data presented here can serve as benchmarking for other practices in the profession.

REFERENCES

Gaunaurd I, et al. *Prosthet Orthot Int* 2015;39(4):314–21, 2015
Borrenpohl D, et al. *Arch of Phys Med Rehabil* 2016;97(7):1053–63.
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Dillon MP, et al. *Prosthet Orthot Int* 2017.

Comprehensive Solutions for People with Charcot-Marie-Tooth

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INTRODUCTION

Over 70 percent of patients diagnosed with Charcot-Marie-Tooth (CMT) will develop pes cavus and fixed deformities bilaterally. About 30 percent will develop pes planus deformities. Thirty-nine percent will also develop clawed toes from muscle imbalances. Both muscular and sensory nerves will be affected. The majority will develop neuropathic pain, such as, pins and needles or burning sensations.

The standard approach to CMT bracing involves only the development of a device meant to counter the simplest of deficiencies such as foot drop. By developing a comprehensive solution that focuses on compensating for stance phase concerns using closed kinetic chain bracing, the outcome metrics show noticeable improvement in performance, comfort, and joint protection. These improvements cannot be attributed purely to the device, but to the reintroduction of proper mechanical gait patterns through specialized training that utilizes the strengths of the devices. Without a device that properly addresses stability and security concerns, this type of training is not possible.

Through triplanar management, not only is in-brace performance increased, but limb remodeling also can occur over time. By applying corrective forces in three dimensions, an orthosis can correct musculoskeletal deformities and reduce unnecessary surgeries. A better understanding of pathological issues and the corrective forces needed to counter them allows for more natural and efficient biomechanical gait. Providing the correction with security in the stance phase is key to enhancing the quality of life of patients and reducing the total amount spent on care during the life of the patient through preventative care.

A case study of a 38-year old male with (CMT) shows the potential and proven outcomes from a triplanar orthosis in the categories of activity level, comfort, and remodeling of deformities through a complete solution.

METHOD

Subjects: One male; 38 years old; 5 ft. 10 in. tall; 165 lbs.; Charcot-Marie-Tooth; devices: ankle wrap, Hanger molded leather boot, Noodle AFOs, Dynamic Bracing Solutions DR3 AFOs.

Apparatus: ProtoKinetics 18 ft. x 3 ft. Zeno Walkway with three video cameras, weight-bearing X-rays, Cannon DSLR Camera, questionnaire, before and after interviews.

Procedures: The patient was asked to walk on a Zeno Walkway at multiple speeds under two conditions at fitting and at one month and three months post-fitting: (1) with shoes only and (2) with a DBS DR3 orthosis. X-rays were taken after fitting. A questionnaire was taken at fitting and three months post fitting.

Data Analysis: Processing of data was done using ProtoKinetics software. X-ray analysis was done at Wilshire image center.

RESULTS

Self-selected walking speed (SSVVS) increased by 44 percent between barefoot and DBS on day one. Self-reported joint pain was reduced from 8/10 to 0/10. Ankle and foot inversion reduced from -34 to +3 degrees in three months. X-ray documented elimination of joint impingement and bony alignment. Prevented ankle and foot fusion surgery. Walking distance increased from a 1/4 mile to 6+ miles. The subject can now walk on uneven terrain and gained ability to walk carrying heavy items. Standing time increased from one hour to 10–12 hours during work and up to 16 hours per day total.

DISCUSSION

The advanced orthotic methods work for most neuromuscular disorders with lower-limb paralysis. Most deformities of the foot and ankle are acquired and are preventable. They are often correctable with triplanar management remodeling techniques. Triplanar support systems improve alignment by protecting joint surface orientation under full weight bearing. This leads to a reduction in pain while function and activities improve.

CONCLUSION

Effectively using triplanar management coupled with a dynamic response to enable higher function as well as training a patient to take advantage of reestablished alignment and the natural mechanical levers offering security, leads to massive improvements in lower-limb orthotic care. Sophisticated methods for solution development enable better quality of life for the individual with CMT and reduce long-term healthcare costs including increased activities, preventing surgeries, and pain medications

CLINICAL APPLICATIONS

Millions of potential people afflicted with neuromuscular issues can benefit from closed kinetic chain bracing methods with the development of more comprehensive standing, walking, and running solutions. Transitioning from traditional bracing practices to a complete solution based approach can improve patient productivity and activity.

QUESTIONNAIRE
OS5 (19)
Orthotics and Prosthetics: Outcome studies

INSTRUCTIONS

- Read through the article and answer the multiple-choice questions provided below. There is only ONE correct answer to each question.

The rockers of gait: a need for debate?

Question 1: Which of the following is the proposed definition of rockers?

- **A:** The pivot points in the gait cycle
- **B:** The mechanisms of the ankle and foot that produce shank kinematics during stance phase.
- **C:** The production of tibial advancement during stance.

Question 2: According to the rockers of gait study which one of the following is incorrect regarding the second rocker?

- **A:** Single support, 5° recline to 10° incline in shank kinematics, horizontal foot kinematics
- **B:** 10-30% gait cycle, 5° plantarflexion to 10° dorsiflexion in ankle kinematics
- **C:** Plantar flexors act to rapidly move the ankle joint from dorsiflexion to plantarflexion and create further heel rise

Developing a competence-based P&O core curriculum: A Delphi study

Question 3: Is it TRUE or FALSE that there is no international consensus regarding core competencies for prosthetics and orthotics?

- **A:** TRUE
- **B:** FALSE

Question 4: Which statement is incorrect with regard to the competence-based curriculum study?

- **A:** The first round of Delphi statements were generated and distributed as a questionnaire to an expert panel of 40 individuals.
- **B:** Eighty-five percent agreement was chosen as the consensus level.
- **C:** Experts were provided with feedback related to round one in the second round.

Entrustment trends in orthotics and prosthetics clinical residency: A preliminary report

Question 5: Which statement is incorrect with regard to the entrustment trend report?

- **A:** For residency characteristics preceptors reported the length of managed residency.
- **B:** Preceptors reported if their residents focused on orthotics, prosthetics or both.
- **C:** For residency characteristics general skills were rank ordered from least to most impactful.

Question 6: Which statement is correct with regard to entrustment trends?

- **A:** The younger the respondent the more likely the respondent reported educating residents in practice management and documentation.
- **B:** Female respondents were more likely to indicate they spent more time educating residents in patient assessment.
- **C:** Preceptors ranked evaluation as the least impactful among the five general skills on entrusting tasks.

The Baylor College of Medicine residency model: description, reflection, and progress

Question 7: What was the primary objective of the Baylor College of Medicine (BCM) residency model study?

- **A:** To use clinical experience data to improve the clinical education curriculum.
- **B:** To determine the number of cases logged as independently performed.
- **C:** To describe and quantify the BCM Orthotics and Prosthetics Program clinical residency experience.

Question 8: With regard to the Baylor College model which statement is incorrect?

- **A:** Residents were significantly less likely to log procedures as independently performed if they logged more cases involving transfemoral or transtibial prostheses.
- **B:** The Baylor College of Medicine clinical rotation residency model allows for extensive exposure to a variety of clinic settings and patients.
- **C:** The study represents the beginning of an effort to establish normative data and best practices for orthotics and prosthetics clinical education.

Experience integrating outcome measures in routine O & P practice

Question 9: Which statement is correct with regard to the experience integrating outcome measures study?

- **A:** Staff and new hires did not receive outcome measures (OM) education and training on the specific OM instruments in the battery.
- **B:** To increase performance, the utility of the OM data collection to the individual practitioner and patient was enhanced in several ways.
- **C:** Trends of high OM reporting percentages were noted with newly hired practitioners.

Question 10: Is it TRUE or FALSE that the outcome measure performance per annual quarter for Q4 of 2016 was 60%?

- **A:** TRUE
- **B:** FALSE

Comprehensive solutions for people with Charcot-Marie - Tooth

Question 11: Which statement is incorrect with regard to people with Charcot-Marie-Tooth (CMT)?

- **A:** Over 70% of patients diagnosed with CMT will develop pes cavus
- **B:** Forty-nine percent will also develop clawed toes from muscle imbalance
- **C:** The majority of patients will develop neuropathic pain

Question 12: Which of the following is FALSE with regard to triplanar management?

- **A:** Limb remodeling does not occur
- **B:** In-brace performance increases
- **C:** Limb remodeling can occur over time

Question 13: Which statement is correct with regard to the results of the study?

- **A:** Self-selected walking speed increased by 54% between barefoot and DBS on day one
- **B:** Ankle and foot inversion increased from +3 to -34 degrees in three months
- **C:** Self-reported joint pain reduced from 8/10 to 0/10

END

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ANSWER SHEET

OS5 (19)

Orthotics and Prosthetics: Outcome studies

	A	B	C	D	E		A	B	C	D	E
1						8					
2						9					
3						10					
4						11					
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6						13					
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