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Practice Analysis of Practitioners in Prosthetic and Orthotic Industry in Malaysia

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***Abstract*—Profession in prosthetic and orthotic must show their respects toward patient's dignity, rights and values as stated by Ministry of Health Malaysia. Plus, efficiency in delivering services is important and must stress on the quality of devices used to meet the satisfaction among patients. Act and regulations are always changing, hence the medical and technical staff need to follow-up to achieve the standardisation of medical professions (Andrysek, Christensen & Dupuis, 2010). The objectives of this study is to determine the demographic and professional characteristics and to identify the roles and responsibility of practitioners in prosthetic and orthotic industry in Malaysia. A researcher also wants to identify the qualifications of education attained in any discipline among the P&O practitioners.**

There are fourteen companies throughout Malaysia offering prosthetic and orthotic services have been involved in the questionnaires conducted by the researcher. In this study, the researcher focused on technical and non-technical staff, but more emphasized on CPO and technician. The researcher will study the background of the company as well as the efficacy of clinical and technical staff. In addition, the researcher will analyse the practice areas based on the percentage of time in connection with prosthesis and orthoses by using descriptive analysis. The elements factor analysis of the survey results revealed P&O practitioners' practice. These include professional background, domains, tasks, knowledge, skills and the nature of work to perform while delivering the services directly to patients. This study provides numerical data about the practice of practitioners in prosthetic and orthotic industry. The findings of the data are essential in order to improve the quality and efficacy of technical and non-technical staff in P&O.

Keywords—demographic; professional characteristics; roles; responsibility; qualifications; Malaysia

I. INTRODUCTION

Most of the country facing with a problem where government and non-government institution allocate to little or no funds for expanding the rehabilitation centre in the country. Hence, it will cause problem to start, run and expand the prosthetic and orthotic industry in a country. P&O industry is competing with another unit of hospitalization which is more serious and need more attention and cares. Plus, funds for this industry is important in order to provide a good services and devices toward patients (WHO & ISPO, 2003).

In addition, low-income and developing countries show that the demand of prosthetic and orthotic devices are increasingly by year. Besides that, it is too difficult to obtain prostheses and orthoses because of the price is too expensive. More than 24 million of people live in low-income and developing countries are in need the orthopaedic services. There are many factors contributing to limb deficiency for instance, diseases, accidents, natural disasters, continuous conflicts and birth defect. A patient can get P&O services throughout many countries, but it is too

difficult to get efficacy services due to inappropriate technologists, too low quality and the number of practitioner is insufficient (Magnusson, 2014).

Prosthetic and orthotic practitioners might loss of output and trust from patients and their family if an accident or injuries occur while delivering the services and sometimes it may cause mortality, permanent disability and non-permanent disability. Plus, injuries in workplace are costly because the employers need to support the medical expenses and insurance compensation (Barreto, 2000; Brown, 1996; Gregory, 2000). Every practitioner must practice the aspects of safety before, during and after conduct the services. Even though some of the practitioners have many experience in P&O industry, they need to seek an advice and guidance from other professional in terms of expanding their knowledge and skills (HCPC, 2013).

II. METHODOLOGY

A. Study Overview

A questionnaire was prepared based on the research objectives and an initial review of literature. The questionnaire is adapted from American Board for Certification in Orthotics, Prosthetics & Pedorthics, Inc. (2015). The researcher conducts a survey directly towards respondents. At the initial stage of the survey, a researcher needs to ask a permission and approval from the director's company.

B. Participants

The database of prosthetics and orthotics practitioner in Malaysia was obtained from fourteen companies. Every company has a different number of workforce due to respond to this survey and not all participated.

Table 1. Name of companies and the number of respondents that participate in the survey

Company Identification(s)	Number of Respondent(s)
C1	6
C2	5
C3	7
C4	5
C5	5
C6	4
C7	5
C8	11
C9	6
C10	2
C11	3
C12	1
C13	2
C14	2

C. Instrument

A questionnaire was designed to analyse the practice of prosthetic and orthotic practitioners in Malaysia. The elements in the surveys were based on the Practice Analysis of Certified Practitioners in the Disciplines of Orthotics and Prosthetics. This study performed in related fields including professional background, work setting, demographic information, domains, tasks, knowledge, skill statements, practice areas and devices. Thus, the elements in the questionnaire have been suited with P&O field. Sections in the survey were broadly categorised into three sections, including (1) company background, (2) clinical and technical staff competency and (3) practice areas and devices.

More specifically, the 'demographics' section included predominantly of respondents' demographics with 12 items in regard of professional history, work environment, educational background and demographic information. The ten items in the 'clinical and technical staff competency' section aimed to identify the primary work setting and which of these works they are most likely to perform. The 'practice areas and devices' section consisted of three items aimed to identify respondents spend time in their practice areas plus respondents were asked the percentage of orthoses/prostheses fabricated onsite or in a central fabrication facility.

As to identify the domain of practice, respondents will express their level of frequency of task and activity within a domain of practice for the past 12 months on a five point Likert scale, with the options (1) never, (2) rarely, (3) occasionally, (4) frequently and (5) routinely. Statements were state positively and negatively and it will not to reflect the preferences toward ABC certifications.

D. Analysis

Data from the fourteen companies were organised and analysed into bar graphs, percentages, average, mean, pie charts and data collection method. Location of the study was determined earliest so that the researcher will always on the track. The location was determined by the location of P&O centres.

III. RESULTS

A. *Company Background*

Target of company throughout Malaysia as the respondent must provide prosthetic and orthotic services. Overall, the total number of workforce in the prosthetic and orthotic industry is 113 including technical and non-technical. Out of this total, 51 (45.1%) of workers who served as CPOs and technicians responded to the survey while seven (6.2%) workers were not involved because they were outstation. The rest, 55 (48.7%) of non-technical workers consisting of directors, managers, administrators, finance, human resources and others. Fourteen companies are enclosing from the capital city of Malaysia, east coast, Sabah and Sarawak.

Based on fourteen companies that responded, the University Malaya Medical Centre is a long established company of 47 years, which began in 1970 and was followed by Art Niaga Malaysia Sdn Bhd for 34 years and was formed in 1983. However, there is also a new company engage in prosthetic and orthotic services where they have been in this industry for less than 10 years. On average, Malaysia has a prosthetic and orthotic service centre between 15 to 40 years of establishment. According to Robert and Michael in the Journal of Business Venturing, a long established company has strong financial resources, business skills in terms of management and manpower (Robert & Michael, 1986).

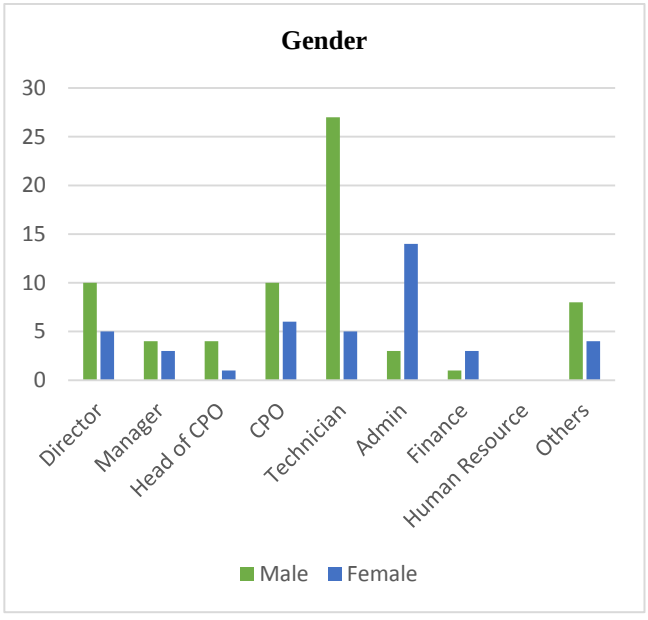


Figure 1. Percentage of gender's respondent for each position in prosthetic and orthotic industry in Malaysia and male indicate a greater number in the most position of P&O except for the administration and financial management where it is dominated by female.

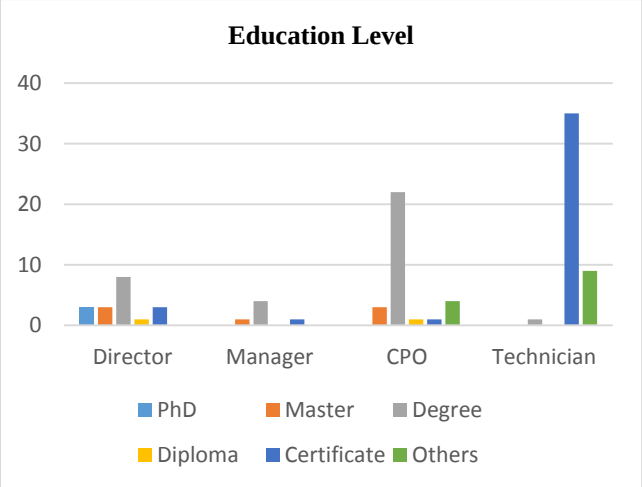
Based on the Figure 1 above, the total number for male respondent is 67 (62%) and this number is more than female respondent which is 41 (38%). In a word, it showed that more men are involved in the prosthetic and orthotic industry. This situation is caused by women having a very low level of awareness in the field of profession as compared to men who tend to further their studies and subsequently obtain training in the prosthetic and orthotic industry (Sandra, 2016).

The position of the director shows that it is held by the age of 45-54 years with a total of six (5.6%) of the total responding companies. While for managerial positions were dominated by those aged 55-64 with a total of four (3.7%). According to Ernie (2013), in every organisation that conducts business operation, both in terms of goods and services, the director and manager are the main pillar in ensuring that the operation is well and perfect. The difference between director and manager is the director will provide guidance and encourage other employees. In contrast to the manager, his job is to give an instruction and conduct the management of the company (Ernie, 2013).

Administration of a company is dominated by people aged between 25-34 years. At this stage it is known as entry level or junior executive and it is dominated by female as well as financial management position. For this position, it shows that aged 45-54 is greater than other age because they are more experienced in company management. Commonly, many firms tend to hire for entry level positions because it is required minimum qualifications, with or no experience. The candidate who applied for this level of position is usually fresh graduate and does not have any career planning in future. Junior executive is one of the middle levels in organisation and often hired internally (Radha, 2007). For human resource position it does not record any amount or percentage as there is no specific task for this position in the P&O industry.

In prosthetic and orthotic industry, for technical position is divided into two which are certified prosthetic and orthotic (CPOs) and technicians. Some of the respondent companies, they have got the head of CPO and others have not got and were led by a director or manager. For the head of CPO and CPO itself show that the age group of 25-34 indicates a larger number of workers with a total number of four (3.7%) and thirteen (12%) respectively. There is only one (0.9%) of worker in the age group of 55-64 that represent for these positions. Differ to technician, at the age group of 35-44 indicates 12 (11.1%) of workers and the least number is at the age above than 65 years old with one (0.9%) of the worker while at the age of 55-64 is remaining zero.

Figure 2. Percentage of education level attained by technical and non-technical workforce in the prosthetic and orthotic industry in Malaysia.



A total of 77 Malaysian respondents attained higher or lower education levels. In this section, the researcher focused on four positions only, namely as director, manager, CPO and technician. The rest such as administration, finance, human resource and others are not emphasized. This is because the four main positions are directly related to patients whose need prosthetic and orthotic services. Countries such as Malaysia, Sri Lanka, Thailand, Cambodia, Vietnam and China from south East Asia have their own prosthetic and orthotic educational institutions with two types of programs. The student can choose either they want to continue in the four year programme or three year educational course. Plus, a German governmental organisation giving a support in terms of financial and technical aspects to the China Training Centre for Orthopaedic Technologists (CHTCOT), Vietnamese Training Centre for Orthopaedic Technologists (VIETCOT) and University of Malaya (Kazuhiro, 2006; Malas, 2002).

Refer to Figure 2 above, degree level shows the highest number compared to another level of education which is six (8%) of directors attained this qualification. In this position, there are only two people (3%) whose have certificate in P&O. Total number for manager is five person and only three person (4%) attained in degree course while the other two person have master and certificate respectively. Next, 17 of CPOs (22%) have attended degree level of education and there is no one further study in doctoral (PhD). Lastly, in the position of technician shows that the highest number is certificate with 27 of technicians (35%) and only one person attend in degree level while PhD, master and diploma remaining zero.

The directors (6.52%) have an experience in P&O industry with less than five years old and there is only 3 (3.26%) of them have more than 31 years of experience. Similar with head of CPO and CPO, experience with less than five years indicates bigger number which are 4 (4.35%) and 10 (10.87%) respectively. Managers in P&O industry stated that there are 2 (2.17%) person with less than five years of experience, 6 to 10 years and followed by more than 31 years. Technicians with 11 to 20 years of experience have highest number compared with others positions which is 13 person (14.13%). Technicians with less than five years of experience shows the least number with 4 (4.35%) only.

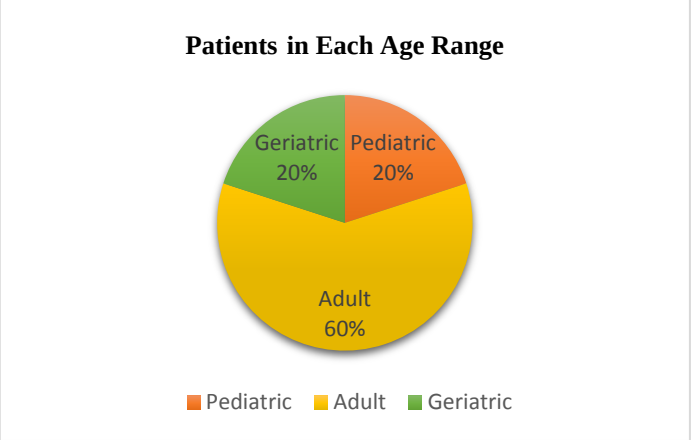


Figure 3. Percentage of patients in each age range.

Figure 3 documents the age distribution of patients by discipline. Patients are likely to be adult age (60%) or geriatric (20%) and only somewhat similar to be pediatric age (20%). The survey showed that in prosthetic and orthotic industry, patients were slightly more likely to be more adult age than to be pediatric and geriatric age.

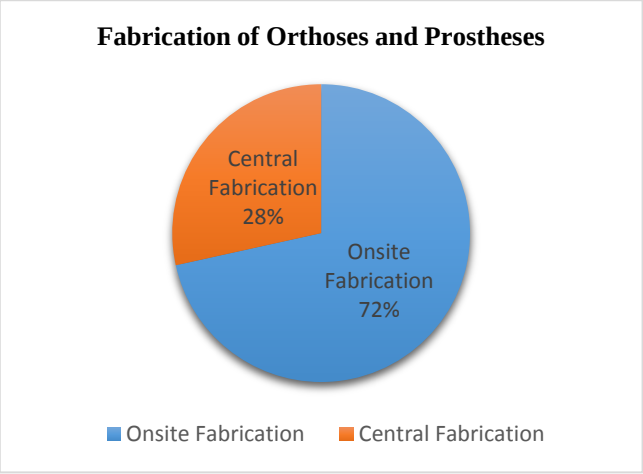


Figure 4. Percentage of orthoses and prostheses fabricated onsite or in a central fabrication facility.

In regard to fabrication, respondents were asked the percentage of orthoses and prostheses fabricated onsite or in a central fabrication facility. As refer to the Figure 4, both orthoses and prostheses were more likely to be fabricated onsite (72%) than at a central fabrication facility (28%).

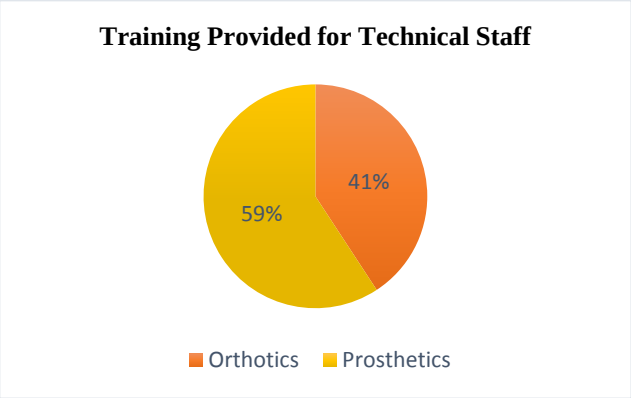


Figure 5. Percentage of orthotics and prosthetics training provided for the technical staff for the last 12 months.

As seen in the Figure 5 above, respondents were asked the percentage of orthotics and prosthetics training provided for the technical staff for the last 12 months. Both orthotics and prosthetics training for the technical staff were more likely to be prosthetics (59%) than orthotics (41%).

B. Clinical and Technical Staff Competency

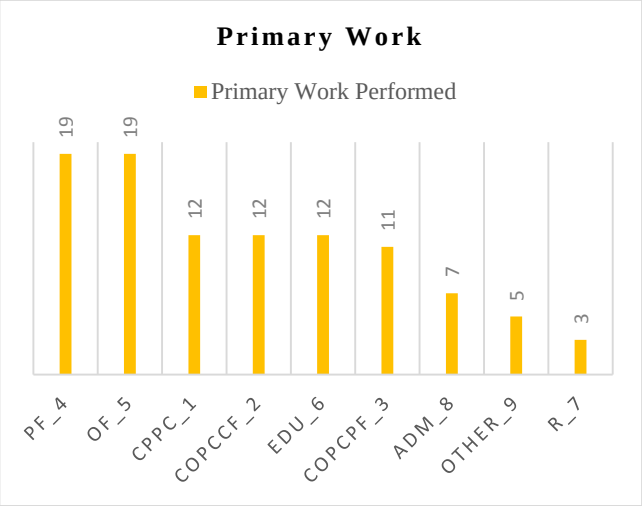


Figure 6. Percentage of primary work performed in prosthetics and orthotics according to descending order.

As seen in Figure 6, the bar chart is arrange in descending order to show that the most primary work performed to the least work performed. The highest primary work performed devotes 38% of their work time (about 19% in partial foot and this percentage is same with orthotic fabrication). Next, the modest primary work performed were dominated by clinical prosthetic patient care, clinical orthotic patient care (custom fabricated) and education with 12% respectively. It was followed by clinical orthotic patient care (pre-fabricated) with 11%. Least work performed indicates 15% of activities; 7% to administration; 5% related to other work and about 3% in research. A small amount of time is being spent in what is now reported as time spent in 'research'. Should be noticed that, respondents were asked to tick more than one type of primary work if it is necessary.

Table 4. Descriptive statistics for domains frequency

Domains	Percentage of Time[1]	
	P[2]	O[3]
Domain 1 – Patient Assessment	51.79%	48.21%
Domain 2 – Formulation of the Treatment Plan	51.75%	48.25%
Domain 3 – Implementation of the Treatment Plan	49.2%	50.8%
Domain 4 – Follow-up the Treatment	52.15%	47.85%
Domain 5 – Practice Management	52.19%	47.81%
Domain 6 – Promotion of Competency and Enhancement of Professional	51.48%	48.52%

[1] Overall what percentage of your work did you spend performing the tasks related to each domain during the past year?
[2] P indicates as prosthetics
[3] O indicates as orthotics

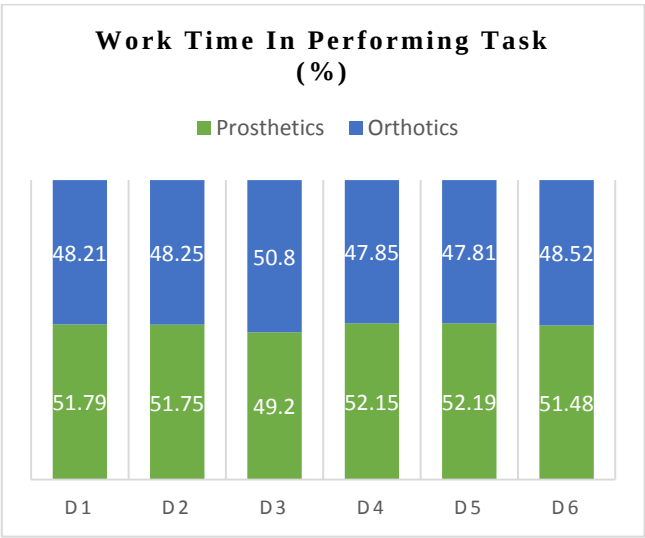


Figure 7. Percentage of work time that workforce spend in performing the tasks related to each domain during last 12 months. Domains are global areas of responsibility performed by credentialed professionals.

Table 4 presents the results of the Percentage of Time for Certified Practitioners in both disciplines. As can be seen, Certified Practitioners in prosthetics discipline indicated that they spend the most time performing task associated with either Follow-up the Treatment and Practice Management. Regardless of discipline, respondents spend between 52.15% and 52.19% of their time in each of these two domains.

Respondents spend the least time performing tasks associated with Implementation of Treatment Plan (49.2%) in prosthetic discipline where in orthotic discipline it were be Follow-up the Treatment and Practice Management, 47.85% and 47.81% respectively. Differ in orthotic discipline, it showed that the most time performing task was Implementation of Treatment Plan with 50.8%. They spend between 51.67% in prosthetic discipline and 48.33% in orthotic discipline in order performing tasks associated with each of the remaining three specifically delineated domains – Patient Assessment, Formulation of the Treatment Plan and Promotion of Competency and Enhancement of Professional.

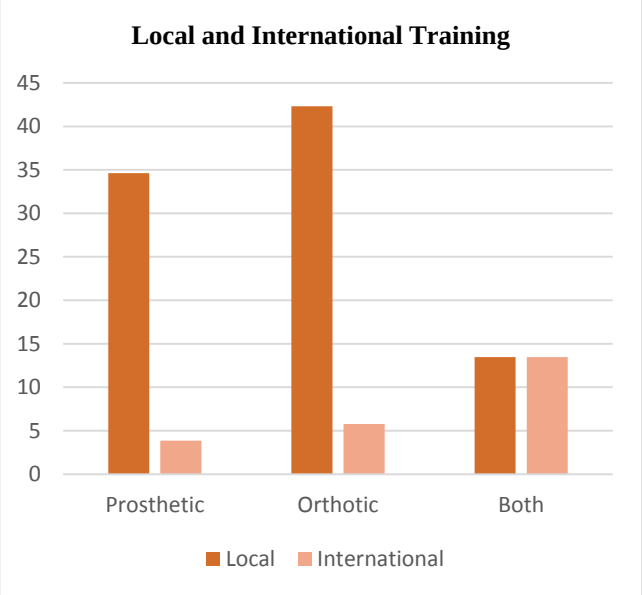


Figure 8. Percentage of workforce that attended in any local and international training in the past three years.

As seen in Figure 8, Certified Practitioners need to state if they have attend any local and international training in the past three years in one or both of disciplines. Certified Practitioners indicated 38.47% that they attend in prosthetic field; about 34.62% attend in local training and 3.85% attend in international training for the past three years. About 48.08% Certified Practitioners attended in local and international training for orthotic which are 42.31% and 5.77% respectively. There are also practitioners attending local and international training in both disciplines with a percentage of 13.46%.

C. Practice Areas and Devices

Table 11. Average of time in practice areas with regard to orthoses.

Practice Areas	Average
Lower Extremity	49.51
Spinal	18.53
Upper Extremity	13.37
Cranial	4.35
Other	4.43

Table 11 documents the average of time Certified Orthotists spend in various orthotic practice areas. As can be seen, these practitioners spend near to half of their time in the lower extremity practice area and all but average of cranial is 4.35, where other stated 4.43. The findings of these rating activities should be review very carefully, as they provide guidance with regard to the development and or refinement of ABC's Certification examinations.

Table 12. Average of time in practice areas with regard to prostheses.

Practice Areas	Average
Partial Foot	32.57
Symes	27.29
Transtibial	107.57
Van Ness Rotationplasty	7
Knee Disarticulation	17.71
Transfemoral	50.50
Hip Disarticulation or Hemipelvectomy	10
Partial Hand	11.86
Wrist Disarticulation	10.43
Transradial	16.64
Transhumeral or Elbow Disarticulation	12.71
Shoulder Disarticulation	11
Congenital Limb Deficiency	15.79

Certified Prosthetists completed 13 tasks related to the array of prosthetics they provide to their patients and or to a description of the patients. As displayed in Table 12, of the 13 specifically enumerated practice areas, respondents spend the most time in average among of 14 companies, 107.57, in transtibial practice area followed by 50.50 which is an average of transfemoral practice area. They spend no more than average of 50 in any other practice area.

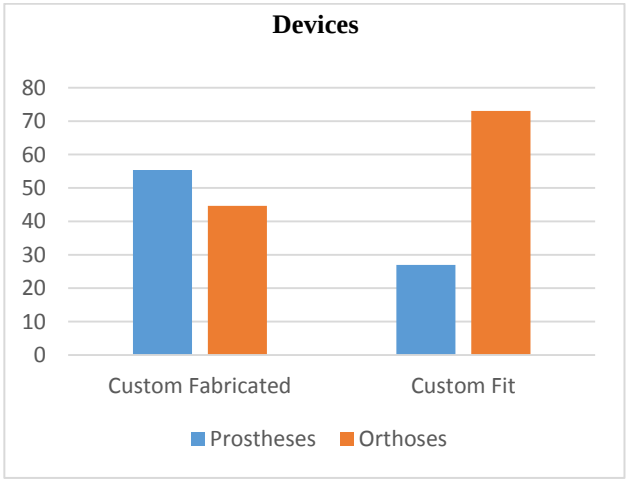


Figure 9. Percentage of devices in each category of prostheses and orthoses.

As documented in Figure 9, Certified Prosthetics indicated that they perform nearly all tasks in connection with the specifically delineated types of prostheses and orthoses devices. Respondents were asked the percentage of devices in each categories. As can be seen, category for custom fabricated to patient model indicated the highest one is to be prostheses with 55.37% where lowest number is dominate by orthoses with 44.63%. Category for custom fit indicate the lowest number is to be prostheses with 26.97% and orthoses recorded the highest percentage with 73.03%.

IV. Discussion

Researcher would like to highlights related to professional background, work setting and demographic information. About 42% of the orthotic and prosthetic credentialed sample had less than five years of experience in orthotics and prosthetics. About 40% of the Certified Practitioners in orthotics and prosthetics earned a certificate in O/P and followed by baccalaureate degree. Certified Prosthetists indicated that they spend the most time performing tasks associated with Follow-up the Treatment (52.15%) and Practice Management (52.19%) while Certified Orthotists spent the most time in Implementation of the Treatment Plan (50.80%). The overall pattern of the frequency ratings on the tasks indicates that the practice analysis delineation included critical tasks performed by Certified Practitioners in both disciplines and it validates the use of these tasks in an examination development (Catherine, 2015).

This study is to reflect the presentation of practice analysis especially in prosthetic and orthotic industry in Malaysia, predominantly in technical and non-technical workforce. This study presents an initial steps in obtaining empirical data to gain a better understanding of the practitioners in P&O industry. The finding suggest that all the practitioners perceive to be highly performed in clinical practice and management team. It cannot even be denied that some barriers are exist such as time constraints, workload and lack of skill and knowledge in performing the work setting.

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References

1. Andrysek, Christensen & Dupuis. (2010). Factors influencing evidence-based practice in prosthetics and orthotics. *Journals Sage Publication*, 35(1) 30-38.
2. Barreto. (2000). Predictors of first nonfatal occupational injury following employement in a Brazilian steelworks. *Scandinavian Journal of Work, Environment & Health*, 26(6), 523-528.
3. Brown. (1996). Workplace Safety: A call for research. *Journal of Operations Management*, 14(2), 157-171.
4. Catherine. (2015). American Board for Certification in Orthotics, Prosthetics & Pedorthics. *Practice analysis of certified practitioners in the disciplines of orthotics and prosthetics*.
5. Ernie. (2013). Leadership vs. management - Focus on leadership and management. *Library Journal*.
6. Gregory. (2000). Predicting safe employee behavior in the steel industry: Development and test of a socio technical model. *Journal of Operations Management*, 18(4), 445-465.
7. HCPC. (2013). *Standard of Proficiency - Prosthetists / Orthotists.* London: Park House.
8. Kazuhiro. (2006). International cooperation in terms of prosthetics and orthotics education. *Niigata Journal of Health and Welfare*, 57-64.
9. Magnusson. (2014). *Prosthetic and Orthotic Services in Developing Countries.* Sweden: School of Health Sciences, Jonkoping University.
10. Malas. (2002). Implementing outcome measurement in O & P education. *Journal Prosthetic Orthotic*, 14(2): 78-81.
11. Radha. (2007). *Corporate Planning and Strategic Human Resources Management.* Maharashtra: Nirali Prakashan.
12. Robert & Michael. (1986). Establishing a new business venture unit within a firm. *Journal of Business Venturing*, 307-322.
13. Sandra. (2016). *Rehabilitation of people with physical disabilities in developing countries.* Denmark: ISPO.
14. WHO & ISPO. (2003). The Relationship Between Prosthetics and Orthotics Services and Community based Rehabilitation (CBR). *ISPO/WHO Statement November 2003*, 1-8.