Research Article

Prosthetics and Physiotherapy Center Data Analysis, Sana'a, 2015-2017

Riham Mohammed Al-Dubaiee

Ministry of Public Health and Population, Sana'a, YE

*Corresponding author
Riham Al-Dubaiee, MSc Ministry of Public Health and Population Al-Hasaba, Mazda Street, Sana'a, YE

Executive summary

Introduction: The International Society for Prosthetics and Orthotics and the World Health Organization (WHO) have estimated that people needing prostheses or orthotics and related services represent 0.5% of the population in developing countries; and 30 million people in Africa, Asia, and Latin America require an estimated 180 000 rehabilitation professionals.

In Yemen, the need for prosthesis and physiotherapy is increasing especially current protracted conflict and war. An estimated 28500 people have been left disabled most as a result of a blast, mine, or gunshot after the war erupted. Furthermore, the burden of road traffic injuries in term of disability is high. The Prosthetics and physiotherapy center (PPC) is the only public center providing rehabilitation services in Sana'a. We analyzed PPC data to describe the pattern of attendees and most common causes for disability.

Methods: The Soft copy data in excel format for Prosthetics and physiotherapy Center (PPC) for the period from January 1st, 2015 to December 31st, 2017 was used. For each attendant the following variables: demographic data including age, gender, location and cause, site of disability, and services provided were collected by the system. After the data was cleaned, categorized and translated to English, it was imported to epi info program 7.2 to be analyzed.

Results: The number of attendees was higher in 2016 and 2017 compared to 2015: 37.3%%, 34.1 vs. 28.6. the median age was 28 years (range: 1-110), and males were more affected (61%). 84% of attendees were from Sana'a governorate. The first three causes for attendance were neurological (32.4%), musculoskeletal (25.4%) and injuries (13.8%). Regarding the neurological causes, the most common diagnoses were: disc prolapse (37.9%), ischemic stroke (21.3%) and Cerebral palsy (15.2%). The highest three causes of musculoskeletal causes were flat foot (29.4%), joint stiffness (23.6%) and, muscle spasm (14.9%). For injuries, War injuries (32.4%), undetermined injuries (18.3%) and car accidents (17.1%) were the most common causes. The most affected body pat was lower limbs (43.5%) and 81% of attendees were given Physiotherapy.

Conclusion: The PPC witness increase in number of attendees after the conflict arisen with a male predominance where war injuries constitute around a third of injuries that was the third cause for disability. The two other most common causes were neurological and musculoskeletal causes of disability. PPC Data entry system must be re-visited and re-categorized for diagnosis and body part affected. Quality of data should be improved e.g., through taking proper history and examination. Training of data clerks is a perquisite. PPC Governorate branches should be connected through a network with PPC at the central level to give clearer nationwide picture about the problems of disability and rehabilitation needs.

Abbreviations

CP   Cerebral palsy
MR   Mediterranean Region
GBS   Global burden of disease
ICRC   International Committee of the Red Crescent
PPC   Prosthesis and Physiotherapy Center
SCD   Spinal cord disease
WHO   World Health Organization
YPL   Year's productivity lost

Introduction

Disabilities are health condition refers to disease acute or chronic, injury or trauma or circumstances such as pregnancy, ageing, stress, congenital anomaly, or genetic predisposition. Rehabilitation aims to enhance and restore functional ability and quality of life to those with physical impairments or disabilities. It may offer prosthesis which are an artificial replacement of a part of the body. A prosthesis may be removable as in the case of most prosthetic legs or might be permanently implanted such as artificial hips [1]. Physiotherapy helps to restore movement and function when someone is affected by injury, illness or disability [2].

Worldwide, the existing training facilities for prosthetic and orthotic professionals and other providers of essential rehabilitation services are deeply inadequate in relation to the need [3].

The International Society for Prosthetics and Orthotics and the World Health Organization (WHO) have estimated that people needing prostheses or orthotics and related services represent 0.5% of the population in developing countries; and 30 million people in Africa, Asia, and Latin America require an estimated 180 000 rehabilitation professionals [3].

In Yemen, the need for prosthesis and physiotherapy is increasing. Thousands of people have lost limbs since the conflict started in 2015. An estimated 28500 people have been left disabled most as a result of a blast, mine, or gunshot [4]. Furthermore, the burden of road traffic injuries in term of disability is high [5].

The prosthesis and physiotherapy center (PPC) are one of the major Governmental health utilities that offers rehabilitation services in Yemen. The center receives many cases from different health centers and governorates. Since 2015 till July 2018 the center received more than 58,000 cases which are increasing due to the current conflict and worsening of the socio-economic status. The services provided by the PPC are physiotherapy and rehabilitation, prosthetics and orthotics and hospitals and health centers equipment support Services. The center was established in Sana'a with support of International Committee of the Red Crescent (ICRC) in 1967. The current location was constructed in 1982, and the ICRC refunded it in 2002. The ICRC supports the center with raw materials for manufacturing the prosthetics. The center receives many cases from different health centers and governorates.

Objectives of the analysis

1. Describe cases presented to PPC by age, gender and residence.
2. Knowing the most affected systems among PPC cases
3. Determine the leading causes among each affected system
4. Determine the most affected parts of the body.

Methodology

PPC attendees are cases who had functional disability who seek treatment by themselves or referred by their physicians to the Center to receive the services required. From 2015 the PPC started to has a computerized data entry system using B sys program. At the reception, the patient demographic data (e.g., age, gender, residence) is entered and is giving unique number before referral to the physician or physiotherapist who examine the cases and write in the computer the diagnosis, system and site affected and the service needed by the case. The case then goes to the revenue department where is given a card which includes a brief of his demographic, clinical data, services to be offered and the period of treatment. The case is referred then to the suitable unit. Wither therapeutic or supportive. The therapeutic department includes physiotherapy departments or to the technical department to offer supportive orthotics or prosthetics. Each department of the previously mention contains and entry system for the service provided. This system was the source of the data analyzed in this report after exporting it to excel format.

Data analyzed covered the period from January 1st, 2015 to December 31st, 2017. As this the first analysis of the PPC, the data needed a tremendous effort for cleaning, categorizing and translating to English language. The data was categorized e.g., from approximately 600 diagnoses to 90 diagnoses that divided to 10 systems. Also, the affected organs were summarized from 180 body site to 42 and further summarized to 5 main body sites. This was done using excel program. The data was sorted by demographic data including age, gender, location and cause, site of disability, and services provided for cases. later on, analyzed by epi info program 7.2.

Results

A total of 50,780 cases attended the PPC center during the study period: 2015-2017.

Time distribution

2016 witnessed more cases than other years with a percentage of 37.35%.

Table 1: Distribution of cases by year in Physiotherapy and Prosthetics Center, Sana'a 2015-2017

Year	Frequency of cases	Percentage
2015	14497	28.57%
2016	18966	37.35%
2017	17317	34.12%
Total	50780	100.00%

Age distribution

Most of the cases were under 10 years with 22.2%, another peak was seen in the age interval between 20-30 with a percentage of 17.7. The median age is 28 years (range: 1-110). The active and productive age groups i.e., 20-60 represent around 50% of cases
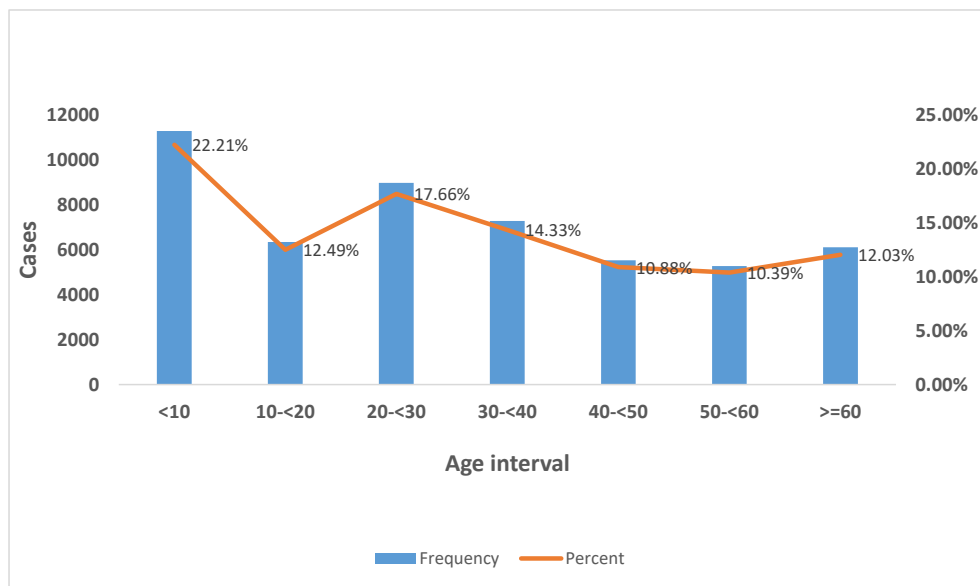

Figure 1: Age distribution of cases in Prosthesis and Physiotherapy Center Sana'a 2015-2017

Gender distribution

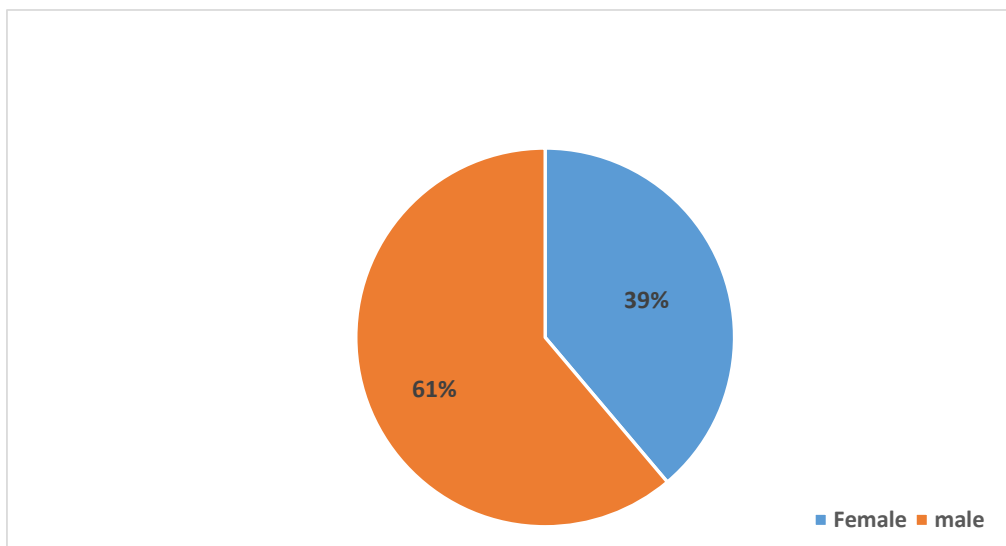Males were found to more affected than females with a percentage of 61.

Figure 2: Gender distribution of cases in Prosthesis and Physiotherapy Center Sana'a 2015-2017

Distribution of cases by governorate

Most of the cases were from Sana'a governorate with a percentage of 84%. Nearby governorates were found to be the next in number to visit PPC however they are few in numbers as Amran and Ibb with 2.4 percentages.

Table 2: Distribution of cases by governorates in Physiotherapy and Prosthetics Center, Sana'a 2015-2017

Governorate	Frequency	Percentage	Governorate	Frequency	Percentage
Sana'a	42677	84.04%	AlJawf	190	0.37%
Ibb	1221	2.40%	AlDhale'e	176	0.35%
Amran	1209	2.38%	Marib	115	0.23%
Dhamar	942	1.86%	Aden	73	0.14%
Taizz	895	1.76%	Shabwah	39	0.08%
Hajjah	814	1.60%	Lahj	37	0.07%
Sa'ada	769	1.51%	Hadramaut	13	0.03%
AlHudaydah	587	1.16%	Abyan	10	0.02%
AlBayda	400	0.79%	Socotra	3	0.01%
Almahweet	363	0.71%	Almahra	1	0.00%
Raymah	246	0.48%			
Total	50780	100%			

General causes of disability

More than 90 causes were found to be related to the disability of cases in PPC. They were grouped in systems and major causes to be familiar with the data. The most common system related to disability were neurological with a percentage of 32.43% then musculoskeletal with a percentage of 25.37%. injuries were the third most common cause of disability in PPC with a percentage of 13.75%. More details are shown in figure 3.
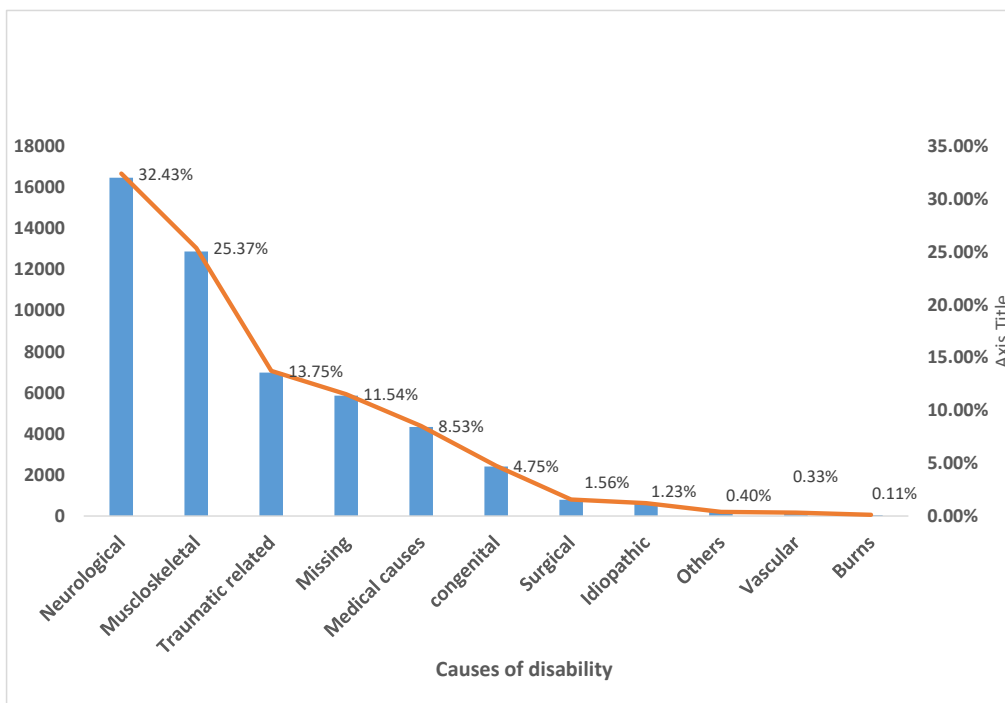

Figure 3 : Causes of disability in Prosthesis and physiotherapy center Sana'a, 2015-2017

Neurological causes of disability

Neurological causes of disability constitute around one third of all diagnoses with a total of 16,468 cases. There were 27 main neurological causes of disability in PPC. The most neurological causes where disc prolapse with a percentage of 37.9%, Ischemic stroke with 21.3%, Cerebral palsy (CP) with 15.24 as shown in table 3. The details of the neurological causes are shown in annex 1.

Diagnosis	frequency	Percentage
Disc prolapse	6245	37.92%
Ischemic stroke	3506	21.29%
Cerebral palsy	2510	15.24%
Facial palsy	1215	7.38%
Nerve injury	790	4.80%
Spinal cord trauma	553	3.36%
Hemorrhagic stroke	465	2.82%
Brain atrophy	277	1.68%
Others	907	5.5%
Total	16,468	100.00

Annex 1: Neurological causes and their distribution in Prosthesis and Physiotherapy, Sana'a 2015-2017

Diagnosis	frequency	Percent	Diagnosis	frequency	Percent
Disc prolapse	6245	37.92%	Brain Tumor	60	0.36%
Ischemic stroke	3506	21.29%	Spinal compression	59	0.36%
Cerebral palsy	2510	15.24%	Encephalitis	52	0.32%
Facial palsy	1215	7.38%	Neuritis	40	0.24%
Nerve injury	790	4.80%	Spinal cord Tumor	32	0.19%
Spinal cord trauma	553	3.36%	Quadriplegia	29	0.18%
Hemorrhagic stroke	465	2.82%	Paraplegia	28	0.17%
Brain atrophy	277	1.68%	Cerebellar injury	18	0.11%
Brachial plexus injury	148	0.90%	Multiple sclerosis	15	0.09%
Meningitis	141	0.86%	Hemiplegia	8	0.05%
Neuropathy	95	0.58%	Hydrocephalus	8	0.05%
Spinal cord inflammation	82	0.50%	Sudeck's atrophy	7	0.04%
Spinal cord viral infection	82	0.50%	Brain cyst	3	0.02%
TOTAL	16,468	Percentage	100.00%		

Musculoskeletal causes

Almost 12,885 cases with a percentage of 25.4% came to PCC due to musculoskeletal causes. The highest five causes of musculoskeletal causes are flat foot, joint stiffness, muscle spasm, arthritis and osteoid with 29.4, 23.6, 15.0, 8.0, 7.50 percentages respectively. These causes and others are shown in Table 4, and further causes are shown in annex 2.

Table 4: Musculoskeletal causes and their distribution in Physiotherapy and Prosthetics Center, Sana'a 2015-2017

Diagnosis	frequency	Percent
Flat foot	3791	29.42%
Joint stiffness	3042	23.61%
Muscle spasm	1928	14.96%
Arthritis	1029	7.99%
Osteoid	970	7.53%
Joint dislocation	427	3.31%
Scoliosis	278	2.16%
Femur's head avascular necrosis	195	1.51%
Tendonitis	194	1.51%
Others	1031	8%
Total	12,885	100.00

Annex 2: Distribution of Musculoskeletal causes by diagnosis, Prosthesis and physiotherapy Center, Sana'a, 2015-2017

Diagnosis	frequency	Percent	Diagnosis	frequency	Percent
Flat foot	3791	29.42%	Vertebral dislocation	101	0.78%
Joint stiffness	3042	23.61%	Vertebral osteomyelitis	87	0.68%
Muscle spasm	1928	14.96%	Muscle weakness	79	0.61%
Arthritis	1029	7.99%	Post Joint replacement	72	0.56%
Osteoid	970	7.53%	Foot corn and callus	69	0.54%
Joint dislocation	427	3.31%	Osteomyelitis	64	0.50%
Scoliosis	278	2.16%	Big toe inversion	55	0.43%
Femur's head avascular necrosis	195	1.51%	Rheumatoid Arthritis	43	0.33%
Tendonitis	194	1.51%	Kyphosis	37	0.29%
Tendon rupture	148	1.15%	Cervical strain	29	0.23%
Myopathy	120	0.93%	Pots disease	7	0.05%
Tear of meniscus	115	0.89%	Foot inversion	5	0.04%
TOTAL	**Cases**	**12,885**	**Percentage**		**100.00%**

Injuries causes

There were 6,982 cases (13.8%) due to injuries. War injuries (32.4%), undetermined injuries (18.3%), car accidents (17.1%) were the most common causes of injuries causes in PPC.
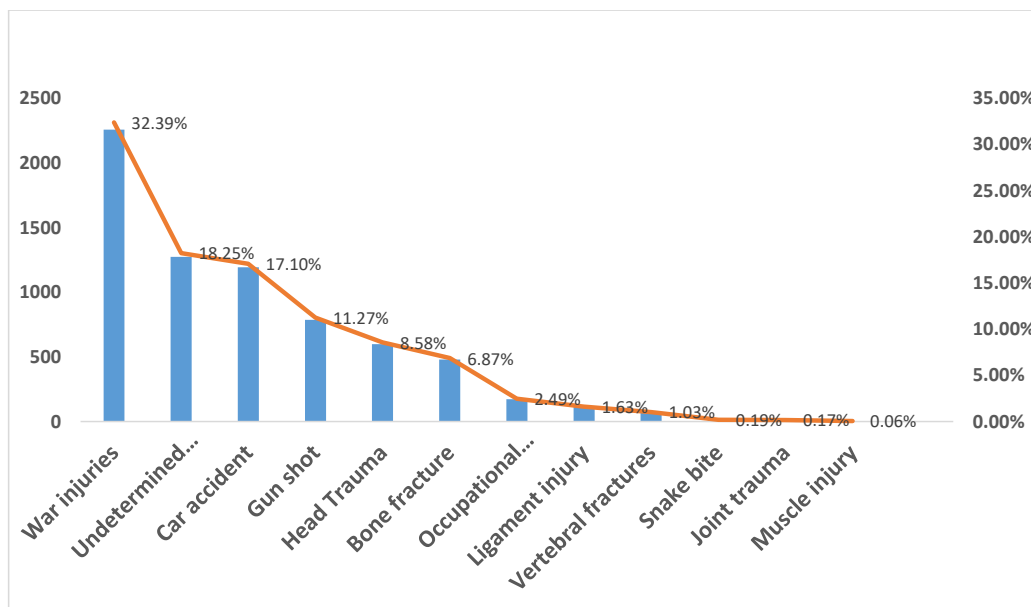
Figure 4 : Injuries in Prosthesis and physiothepapy center, Sana'a ,2015-2017

Disability due to medical causes
The cases those were admitted to PPC due to medical causes were 4,332 cases, with a percentage of 8.5. The most common causes were hypocalcemia: 2205 (50.9%) and hypoxia: 2101(48.5%). Other rare causes included inflammatory causes with a 0.48% and elephantiasis 0.1%.

Disability due to congenital causes
Congenital causes constitute 4.8% with a total number of 2413

cases. The most common cause was congenital deformity that consisted 2324 cases (96.3%). Spina bifida was a cause of 88 (3.7%) of disabled cases. A single case during the whole period of the analysis was the rare disease of Osteogenesis Imperfectia.

Disability due to surgical causes
There were 792 cases with a percentage of 1. 6 due to surgical causes. The most common cause was Gangrene with 489 cases and a 61.7% followed by tumors: 23% as shown in figure 5.
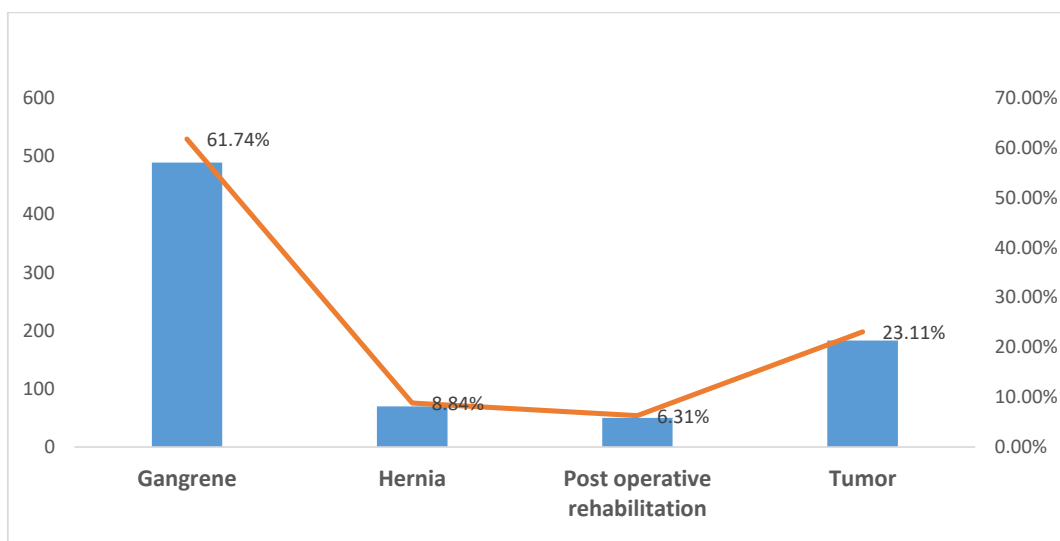

Figure 5: Surgically related causes of disability in Prosthesis and Physiotheray, Sana'a 2015-2017

Disability due to vascular causes
Cases who were diagnosed with a vascular cause consisted 166 cases with a percentage of 0.3. Related diagnosis is shown in figure 6.
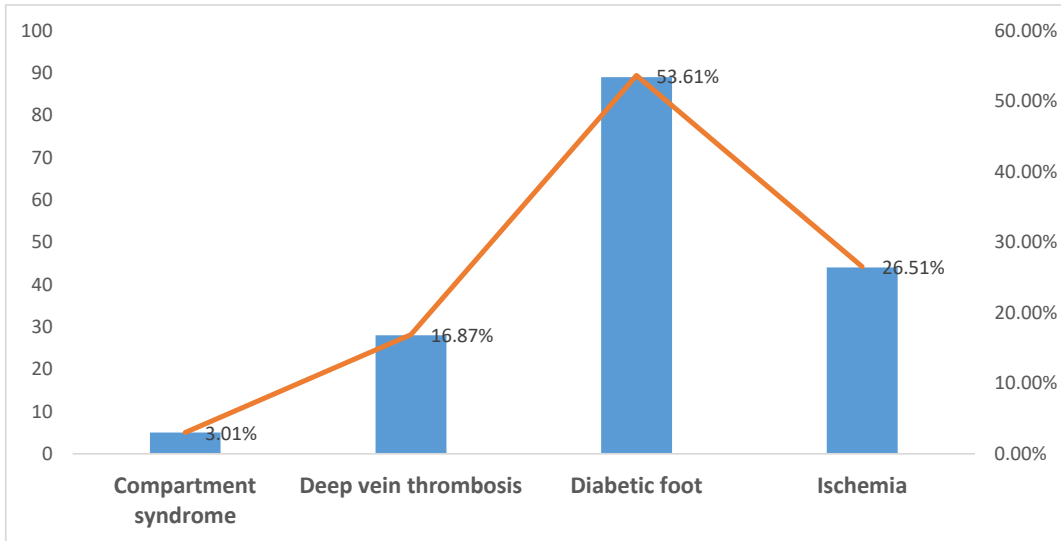
Figure 6: Vascular causes of disabilityt in Prosthesis and Physiotherapy , Sana'a 2015-2017

Other causes of disability

Different rare causes of disability include natural disasters as earth quake, electrical shock, medical errors and rare medical conditions as abdominal floppiness and leprosy were grouped under others causes of disability which consisted only 0.4% of all cases.

Organ affected

There were 42 organs affected in the cases of PPC 2015-2017. The site with highest frequency was lower limbs with 21,795cases and 43.47%, followed by vertebral column 7610 cases and 15%. The causes are shown in figure 7. The remaining causes and their frequencies are shown in annex 3.
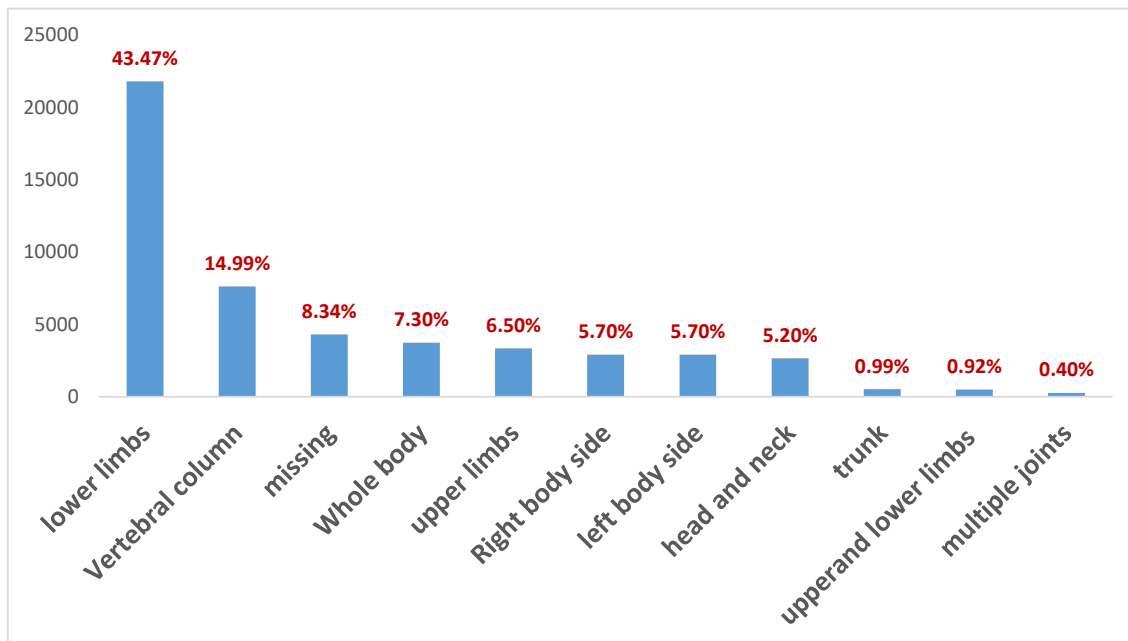

Figure 7: Distribution of affected organs of cases in Prosthesis and physiotherapy Center, Sana'a , 2015-2017

Annex 3: Distribution of affected organs of cases in Prosthesis and Physiotherapy Center 2015-2017

Organ affected	frequency	percentage	Organ affected	frequency	percentage
Vertebral column	7610	14.99%	Left elbow joint	357	0.70%
Feet	7452	14.68%	Right face side	314	0.62%
Missing	4296	8.46%	Left shoulder	287	0.57%
Lower limbs	3852	7.59%	Right upper limb	261	0.51%
Whole body	3717	7.32%	Left face side	253	0.50%
Right lower limb	3232	6.36%	Left upper limb	251	0.49%
Left lower limb	3199	6.30%	Multiple joints	244	0.48%
Right side	2894	5.70%	Heels	166	0.33%
Left side	2875	5.66%	Right wrist joint	166	0.33%
Neck	2011	3.96%	Left wrist joint	160	0.32%
Right foot	817	1.61%	Fingers	123	0.24%
Left foot	743	1.46%	Left ankle joint	97	0.19%
Left knee joint	731	1.44%	Right hip joint	90	0.18%
Right knee joint	660	1.30%	Abdomen	83	0.16%
Knee joints	635	1.25%	Hands	71	0.14%
Right hand	516	1.02%	Right ankle joint	71	0.14%
Left hand	493	0.97%	Jaw	60	0.12%
Upper/lower limbs	467	0.92%	Left thigh	50	0.10%
Right shoulder	465	0.92%	Shoulders	48	0.09%
Pelvis	391	0.77%	Upper limbs	39	0.08%
Right elbow joint	381	0.75%	Chest	31	0.06%
Total	**50780**		**Percentage**	**100.00%**	

Figure 8 shows that 81% of attendees received physiotherapy compared to 19% who needed prosthetics or orthotics.
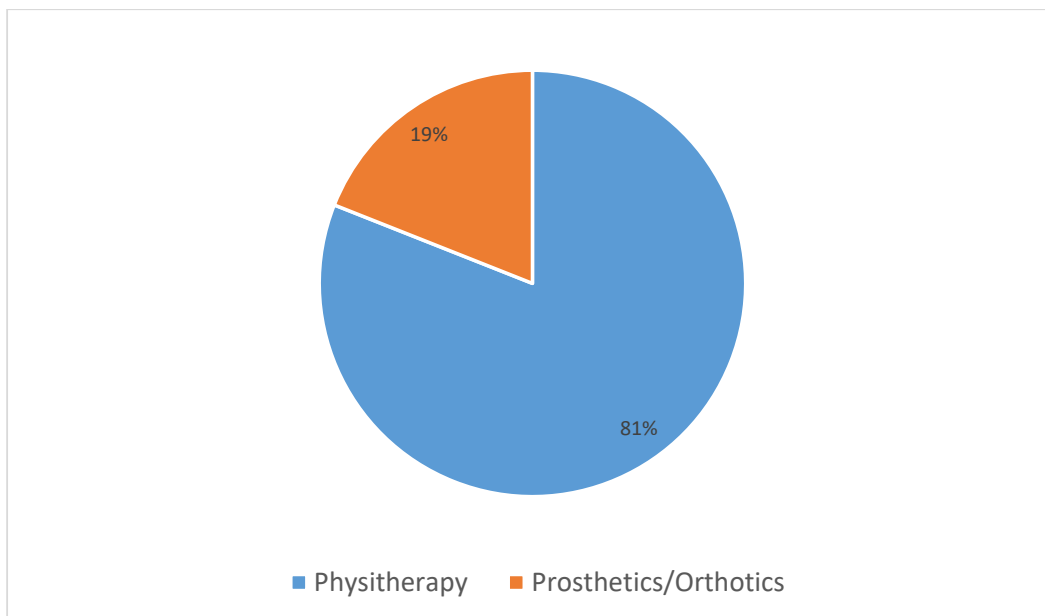

Figure 8: Type of service provided in prosthesis and physiotherapy center, 2015-2017

Discussions

This is the first data analysis that was done on cases attended the PPC. The total number of cases were 50,780 during the period 2015-2017. 2016, 2017 witnessed higher number of cases compared to 2015 the year in which the conflict began. This may be explained by difficulties in access to health services especially at the beginning of the conflict where may injured or disabled were unable to travel to Sana'a city in which the PPC exists. People also were in a shock state at the beginning of the war but then start to adopt to the situation.

Our analysis included wide range of age groups started from birth (e.g., congenital causes of disabilities) till elderly 110 years in which the majority of disabled cases are due to chronic and degenerative diseases. The active and productive age groups i.e., 20-60 represent more than 50% of cases. The negative impact of disability and its leading to years of productivity lost (YPL) at this productive age both at personal level (e.g., difficult to hold a job), family (e.g., loss of family income), and community are tremendous [6].

Male were affected more than females, this might be related due to the high rate of exposure to traumatic events as road traffic accident, occupational, conflict and war injuries, Ischemic attacks as ischemic stroke was one of the highest causes of disability in PPC and it is more common in males. In a population like Yemen where the males are the majority of the working population, such high male predominance among disabled also would have great consequences on family income as well as the country wealth in general.

Most of the cases were from Sana'a governorate and its nearby governorates as Amran. This is related to the location of the PPC and easy accessibility to residents of these two governorates. It's noticed that governorates which has and local rehabilitation centers and nearby governorates such as Hadramout and Aden has minor transferred cases to PPC in Sana'a. The most common causes of disability in PPC were neurological diseases followed by musculoskeletal and injuries.

Regarding the neurological diseases, disc prolapse found to be the first cause, this was agreed with a study done in Egypt [7]. The Ischemic stroke found to be as the second cause of neurologically related disability in PPC. A related study was done in the United Kingdom concluded that stroke is not the most common cause of disability, however it is associated with the highest odds of reporting severe and complex disability [8]. Furthermore, the global burden of diseases (GBS) 2013 suggested that the absolute number of people affected by stroke has substantially increased across all countries in the world over 1990-2013 [9]. Cerebral palsy (CP) found to be the third cause of disability due to neurological causes in PPC. A total of 49 studies were selected and indicated that pooled overall prevalence of CP was 2.11 per 1000 live births, the overall prevalence of CP has remained constant in recent years despite increased survival of at-risk preterm infants [10].

Musculoskeletal causes were the second leading cause of disability in PPC post neurological disorders. In our analysis where arthritis was the fourth underlying cause. A study that was conducted in USA found that musculoskeletal causes especially Specially Arthritis is one of the main causes of disability [11, 12].

Injuries in general are a major cause of mortality and morbidity. In 1998, about 5.8 million people (97.9 per 100,000 population) died of injuries worldwide, and injuries caused 16% of the GBD and causes 10% of global mortality [13, 14]. In this analysis, injuries were the third common cause of disabilities where war injuries were the main causes. In Yemen thousands of people have lost limbs since the conflict started in 2015. An article by the International red cross estimated that 6,000 people have been left disabled most as a result of a blast, mine, or gunshot since the start of the conflict [4]. A supportive study done in turkey stated that Mediterranean Region (MR), gunshot injuries and land mine blasts as the most common traumatic causes of amputations [15].

A common cause of death and disability worldwide as well as in MR is road traffic injuries. For example, in Saudi Arabia between 1971 and 1997; 564 762 people died or were injured in road traffic accidents, a figure equivalent to 3.5% of the total population in Saudi Arabia [16]. In our analysis car accident was one of the most causes of disabilities.

Lower limbs were noticed to have the most frequent site for disability in PPC. They are more prone to be affected with peripheral artery diseases, deep vein thrombosis, diabetic foot, gangrene. Also, many congenital deformities affect lower limbs more as flat foot which has the greatest number of musculoskeletal related cases in PPC. In central nervous system affection, its uncommon to find the affection of the upper extremities without the lower extremities due to the anatomical distribution of nerves. Disc prolapse was the most common cause of neurological disability and lower limbs are more affected. Trauma is also major cause of disabilities and lower limbs are highly affected. Our results are highly supported by a study that was done in India indicating that lower limb amputation is more common than amputation at the upper limb accounted for 94.8% of all amputations and explains the different etiologies [17]. A supportive study also concluded that musculoskeletal complaints are more frequent in the lower extremities than in the upper extremities in childhood [18].

Limitations
1) Poor Data quality and in-consistencies.
2) Poor categorization and multiplication of diagnoses, site of injuries.
3) Demographic data was not taken accurately e.g., Governorate.
4) Unavailability of previous analytical studies for comparison.

Conclusion

The PPC witness increase in number of attendees after the conflict arisen with a male predominance where war injuries constitute around a third of injuries that was the third cause for disability. The active and productive age groups i.e., 20-60 represent around half of cases. Most of the attendees were from Sana'a governorate. The most common system related to disability were neurological then musculoskeletal and injuries. Regarding the neurological causes, the most common diagnoses were: disc prolapse, ischemic stroke and Cerebral palsy. The highest three causes of musculoskeletal causes were flat foot, joint stiffness and, muscle spasm. For Injuries, war injuries, and car accidents were the most common causes. The most affected body part was lower limbs and the majority of attendees were given Physiotherapy.

Recommendation

According to our findings, we recommend the following:
1. Data entry system must be re-visited and re-categorized for diagnosis and body part affected.
2. Quality of data should be improved e.g., through taking proper history and examination.
3. Training of data clerks is a perquisite PPC.
4. Governorate branches should be connected through a network with PPC at the central level to give clearer nationwide picture about the problems of disability and rehabilitation needs.

Brief Description of The Report

We analyzed Prosthetics and physiotherapy center (PPC) data for the period from January 1st, 2015 to December 31st, 2017. For each attendant the following variables are captured by the data entry system: demographic data including age, gender, location and cause, site of disability, and services provided.

Findings

The number of attendees was higher in 2016 and 2017 compared to 2015: 37.3%%, 34.1 vs. 28.6. The median age was 28 years (range: 1-110), and males were more affected (61%). 84% of attendees were from Sana'a governorate. The first three causes for attendance were neurological (32.4%), musculoskeletal (25.4%) and injuries (13.8%). Regarding the neurological causes, the most common diagnoses were: disc prolapse (37.9%), ischemic stroke (21.3%) and Cerebral palsy (15.2%). The highest three causes of musculoskeletal causes were flat foot (29.4%), joint stiffness (23.6%) and, muscle spasm (14.9%). For injuries, War injuries (32.4%), undetermined injuries (18.3%) and car accidents (17.1%) were the most common causes. The most affected body part was lower limbs (43.5%) and 81% of attendees were given Physiotherapy.

Recommendation

Data entry system must be re-visited and re-categorized for diagnosis and body part affected. Quality of data should be improved e.g., through taking proper history and examination.

Training of data clerks is a perquisite. PPC Governorate branches should be connected through a network with PPC at the central level to give clearer nationwide picture about the problems of disability and rehabilitation needs.

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