

Characteristics of Outpatients receiving Physical Therapy Services at a Provincial Hospital in Papua New Guinea: A Descriptive Case Study

Takashi Saito^{1*}, Angelberth Bai¹, Nobuko Matsui², Kazuhiro P. Izawa³, Shuichiro Watanabe⁴, Alfred Malagisa⁵

1. Physiotherapy Department, Kimbe Provincial Hospital, West New Britain Province, Papua New Guinea, Japan
Overseas Cooperation Volunteers, Japan International Cooperation Agency, Tokyo, Japan

2. Department of Physical Therapy, University of Tokyo Health Sciences, Tokyo, Japan

3. Department of Public Health, Graduate School of Health Sciences, Kobe University, Kobe, Japan

4. Department of Gerontology, Graduate School of Gerontology, J F Oberlin University, Tokyo, Japan

5. Medical Services Department, Kimbe Provincial Hospital, West New Britain Province, Papua New Guinea

ABSTRACT

Purpose: Development of Physical Therapy (PT) services for people with disability is one of the urgent challenges in the health sector in Papua New Guinea (PNG). However, information on the current status of PT services in PNG is scarce, as also is the case for the hospital-based outpatient PT services. This study aimed to describe the characteristics of outpatients receiving PT services in a provincial hospital in West New Britain (WNB) Province, PNG and to compare them with the characteristics of inpatients.

Method: This was a retrospective case study using outpatient and inpatient records. The records of clients receiving PT services as either outpatients (413 records, outpatient group) or inpatients (350 records, inpatient group) were reviewed in relation to sex, age and diagnosis. Comparisons were made between the two groups on basis of quantitative data of the two patient groups .

Results: The final analysis comprised 404 records in the outpatient group and 344 records in the inpatient group. In the outpatient group, injury and musculoskeletal disease were forming the most dominant diagnosis groups with 52.5% and 22.0%, respectively. Injury was most common in the age group 20 to 39 years and musculoskeletal diseases was most common in the age group 40 to 59 years. These two diagnosis groups and congenital malformations were significantly more represented among outpatients than among inpatients.

Conclusions: Young to middle-aged clients with injury or musculoskeletal disease were predominant among outpatient PT services as compared to

* **Corresponding Author:** Takashi Saito, Physiotherapy Department, Kimbe Provincial Hospital, P.O.Box 428, Kimbe, West New Britain Province, Papua New Guinea. Email:takashi-riha@live.jp

inpatient services. The study findings serve to provide information on the current situation and potential needs of hospital-based outpatient PT services in one provincial hospital of PNG. These findings could be the base for planning outpatient PT service in WNB Province and PNG.

Key words: *Papua New Guinea, physical and rehabilitation medicine*

INTRODUCTION

Papua New Guinea (PNG), with an estimated 8 million people speaking 841 different languages (World Health Organisation, 2016), is a country located in the Western Pacific that is renowned for its environmental, cultural and biological diversity (National Statistical Office PNG, 2015). The majority (88%) of the population lives in rural areas, with the remaining 12% living in urban areas (National Statistical Office PNG, 2015). Papua New Guinea, experiencing constant economic growth against a backdrop of large-scale developments of mineral and gas resources (Jubilee Australia, 2018), is categorised as a lower-middle-income country according to the World Bank criteria (The World Bank, 2019).

However, some of the health-related statistics of PNG are similar to those of low-income countries (World Health Organisation, 2014). The burden of disease in PNG is largely dominated by communicable diseases such as pneumonia, tuberculosis and diarrhoeal diseases, but the prevalence of non-communicable diseases (NCDs) such as diabetes and ischaemic heart disease is rapidly increasing (World Health Organisation, 2016).

In this health situation, disease-induced disabilities are some of the urgent health-related challenges for the health sector, requiring attention for well-functioning rehabilitation services which are integral to improving the health of people with disability in PNG (Papua New Guinea Ministry of Health, 2010a). Rehabilitation is a set of multi-disciplinary interventions designed to optimise functioning and reduce disability in individuals with health conditions in interaction with their environment (World Health Organisation Regional Office for the Western Pacific, 2019). Physical therapy (PT) is a medical rehabilitation service which is included in the Papua New Guinea National Health Plan 2011-2020 (Papua New Guinea Ministry of Health, 2010a) and is regarded as an important countermeasure to reduce morbidity and prevent early mortality from non-communicable diseases.

Since 2008, PT education at a Bachelor level has been offered in PNG (Karthikeyan and Ramalingam, 2014). However, the PT workforce in PNG is small, with

the number of physical therapists estimated to be approximately 70 (World Confederation of Physical Therapy, 2019). Moreover, information on the current PT services in PNG is scarce (Berg, 1976; Brogan, 1982; Powell, 2001; Shaw, 2004; Saito et al, in press). To encourage the development of the PT profession in terms of both quality and quantity, and to mitigate the disability-related burden, a critical starting point would be to clarify and share knowledge on the current status of PT.

Rehabilitation services including PT in PNG are mainly provided as institution-based services (Shaw, 2004). Few studies on hospital-based inpatient PT services are available (Berg, 1976; Brogan, 1982; Powell, 2001; Saito et al, in press). According to the authors' knowledge, only one report on outpatient PT services has been published (Powell, 2001). Powell (2001), using audit data on medical conditions of inpatients and outpatients receiving PT services in a provincial hospital in PNG, reported that neurological conditions were the most common medical conditions among inpatients while it was musculoskeletal pain among outpatients. This report (Powell, 2001) implied that there might be some differences in the characteristics and PT needs between inpatients and outpatients, and focusing on outpatients would provide unique insights into the current situation of PT services in PNG.

In Powell's study (2001), medical conditions were classified and described on the basis of the clinical manifestations, such as 'chest conditions', 'neurological conditions' and 'orthoepadic conditions'. Hence, information on specific medical diagnoses was not available. Moreover, clients were described as either being a 'child' or 'adult', and thus, demographic information was not available (Powell, 2001). Data on medical diagnoses and demographics is essential to gain a better understanding of the current situation and needs regarding PT services in PNG. This data could be useful to policy makers in planning the provision of outpatients PT services in PNG.

Objective

The objectives of this study were to describe the characteristics of clients receiving hospital-based outpatient PT services and to highlight their characteristic features by comparing them with those of inpatients so that the evidence could be used for planning the provision of PT service in PNG. The hypotheses, which was formulated on basis of the findings of previous studies (Powell, 2001; Saito et al, in press), assumed that medical diagnoses relating to orthopaedic medical

conditions in the young to middle-aged generation would be dominant among outpatients, and there would be significant differences in terms of diagnosis and age group between outpatients and inpatients.

METHOD

Study Design

This was a retrospective case study, using outpatient and inpatient records. The data was collected as part of a research project that explored optimal methods of international cooperation on physical therapy services in PNG.

Study Setting

The study was conducted at Kimbe Provincial Hospital of West New Britain (WNB) Province, PNG. This hospital, which has 180 beds for inpatient care, is the single hospital in WNB Province that provides secondary and tertiary medical services, including inpatient services, outpatient services and community outreach services. Further details on the study setting and study participants can be found in an earlier written – yet unpublished report (Saito et al, in press).

Data Collection

The authors reviewed the records of all clients who received outpatient PT services (Outpatient group) from the 1st of August, 2016, to the 31st of October, 2018; as complete data was available only for this period. These records included data on clients' sex, age and diagnosis. Data items were categorised as follows: sex (female, male); age (<1 year old, 1–4 years old, 5–19 years old, 20–39 years old, 40–59 years old, and ≥60 years old); and diagnosis based on the ICD version 10 (International Classification of Diseases Ver. 10 - ICD-10 code of World Health Organisation, 2019). Data on diagnosis comprised of the medical condition (i.e. the disease) or the disability as relevant to PT services. When names of disability were described and classifications were not completely according to ICD-10 codes, the authors checked the detailed client chart and specified medical conditions and then converted them into the appropriate ICD-10 code.

The authors used data on the characteristics of clients receiving inpatients PT services in Kimbe Provincial Hospital (Inpatient group) that were described in their previous study (Saito et al, in press). The same data collection methodology

and recruitment period were used in both the outpatient and the inpatient groups to ensure that clients' characteristics were comparable between the two.

Exclusion Criteria

During the study's recruitment period, some outpatients and inpatients either restarted or were readmitted for PT services under the same diagnosis. To avoid multiple counting, only the records of the initial utilization of service were included; records of the readmission or restarted outpatient PT services were excluded from the statistical analysis.

Data Analysis

Categorical variables are reported as number and percentages. The clients' characteristics and the diagnosis data were categorised by sex, and the Chi-Square test was used to compare the characteristics between the outpatient and inpatient groups. A two-tailed P value of <0.05 was considered to indicate statistical significance. Statistical analyses were performed with IBM SPSS Statistics (Version 22, IBM Japan Ltd.).

Ethical Consideration

This study was approved by the clinical service directorate of Kimbe Provincial Hospital. All data was kept confidential. As this was a retrospective study, the requirement for informed consent from clients was waived.

RESULTS

In this retrospective survey, 413 records in the Outpatient group and 350 in the Inpatient group were investigated. In the Outpatient group, 9 records were excluded because the clients had restarted outpatient PT services, so 404 records was the final number analysed. In the Inpatient group, 3 records were excluded because of client readmission and another 3 records because of missing data, so 344 records was the final number of records analysed.

Characteristics and Specific Diagnosis by Sex

Characteristics of participants and specific diagnoses in the Outpatient group are shown in Tables 1 and 2, respectively. In Table 1, specific names of the diagnosis groups accounting for 5% and more of the diagnoses in the Outpatient group

are listed; the diagnoses with less than 5% representation are merged into the category 'others'.

Among the clients, the 20 to 39 year age group was the most dominant for both sexes and both groups. Approximately 60% in the Outpatient group and 65% in the Inpatient group were 40 years old or younger.

The five dominant diagnosis-related groups among the Outpatients were injury (ICD-10 codes: S00-S99 and T00-T88), musculoskeletal disease (ICD-10 code: M00-M99), infectious disease (ICD-10 code: A00-B99), congenital malformations (ICD-10 code: Q00-Q99) and circulatory diseases (ICD-10 code: I00-I99) (Table 1). Overall, 52.5% of the outpatients' diagnoses were due to injury, 22.0% due to musculoskeletal disease, 7.20% due to infectious disease, 6.20% due to congenital malformations, and 5.70% due to circulatory disease (Table 1).

Table 1: Participants' Characteristics

	Outpatient group			Inpatient group		
	Female (n=164)	Male (n=240)	Total (n=404)	Female (n=127)	Male (n=217)	Total (n=344)
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Age (years)						
<1	4 (2.40)	7 (2.90)	11 (2.70)	11 (8.66)	11 (5.07)	22 (6.40)
1 to 4	16 (9.80)	16 (6.70)	32 (7.90)	23 (18.1)	24 (11.1)	47 (13.7)
5 to 19	27 (16.5)	38 (15.8)	65 (16.1)	20 (15.8)	38 (17.5)	58 (16.9)
20 to 39	60 (36.6)	78 (32.5)	138 (34.2)	37 (29.1)	57 (26.3)	94 (27.3)
40 to 59	41 (25.0)	74 (30.8)	115 (28.5)	28 (22.1)	56 (25.8)	84 (24.4)
≥60	16 (9.80)	27 (11.3)	43 (10.6)	8 (6.30)	31 (14.3)	39 (11.3)
Diagnosis						
Injury	83 (50.6)	129 (53.8)	212 (52.5)	21 (16.5)	69 (31.8)	90 (26.2)
Musculoskeletal diseases	43 (26.2)	46 (19.2)	89 (22.0)	14 (11.0)	10 (4.61)	24 (7.00)
Infectious diseases	11 (6.70)	18 (7.50)	29 (7.20)	50 (39.4)	65 (30.0)	115 (33.4)
Congenital malformations	10 (6.10)	15 (6.30)	25 (6.20)	3 (2.40)	3 (1.40)	6 (1.70)

Circulatory diseases	3 (1.80)	20(8.30)	23 (5.70)	12 (9.45)	32 (14.8)	44 (12.8)
Others	14 (8.50)	12 (5.00)	26 (6.40)	27 (21.3)	38 (17.5)	65 (18.9)

The two most dominant diagnoses in each of the five diagnosis-related groups were fracture and 'dislocation and sprain of joint' in injury; pain and arthritis in musculoskeletal disease; 'tuberculosis-related disease' and poliomyelitis in infectious diseases; 'congenital deformities of feet' and microcephaly in congenital malformations; and 'cerebrovascular disease' and hypertension in circulatory disease (Table 2). Of the 21 outpatients with congenital deformities of the feet, 14 had congenital talipes equinovarus (CTEV).

Table 2: Diagnosis of the Outpatients Receiving PT Services (by Sex)

	Female (n=164) n (%)	Male (n=240) n (%)	Total (n=404) n (%)
Injury			
Fracture	38 (45.8)	67 (51.9)	105 (49.5)
Dislocation and sprain of joint	27 (32.5)	33 (25.6)	60 (28.3)
Wound or injury	15 (18.1)	29 (22.5)	44 (20.8)
Burns	2 (2.41)	0 (0)	2 (0.94)
Injury of nerves and spinal cord	1 (1.20)	0 (0)	1 (0.47)
(Subtotal)	83 (100)	129 (100)	212 (100)
Musculoskeletal diseases			
Pain - back pain	11 (25.6)	16 (34.8)	27 (30.3)
Pain - except back pain	10 (23.3)	8 (17.4)	18 (20.2)
Arthritis	7 (16.3)	4 (8.70)	11 (12.4)
Adhesive capsulitis	3 (6.98)	2 (4.35)	5 (5.62)
Others	12 (27.9)	16 (34.8)	28 (31.5)
(Subtotal)	43 (100)	46 (100)	89 (100)
Infectious diseases			
TB - Other parts of the body	3 (27.3)	8 (44.4)	11 (37.9)
TB - Meningitis	4 (36.4)	4 (22.2)	8 (27.6)
Respiratory TB	1 (9.09)	5 (27.8)	6 (20.7)
Acute poliomyelitis	3 (27.3)	1 (5.6)	4 (13.8)
Others	0 (0)	0 (0)	0 (0)
(Subtotal)	11 (100)	18 (100)	29 (100)
Congenital malformations			

Congenital deformities of feet	9 (90.0)	12 (80.0)	21 (84.0)
Microcephaly	1 (10.0)	2 (13.3)	3 (12.0)
Others	0 (0)	1 (6.67)	1 (4.00)
(Subtotal)	10 (100)	15 (100)	25 (100)
Circulatory diseases			
Cerebrovascular accident	3 (100)	19 (95.0)	22 (95.7)
Hypertension	0 (0)	1 (5.00)	1 (4.35)
(Subtotal)	3 (100)	20 (100)	23 (100)

TB = tuberculosis

Number of Outpatients among the Five Diagnosis-related Groups (by Age Group)

Table 3 shows the numbers and percentages of each age group among the five dominant diagnosis-related groups. Overall, the dominant age group in injury was the young group (20 to 39 years old). The middle-aged group (40 to 59 years old) accounted for most of the clients with musculoskeletal disease, the adolescent to infant group (less than 20 years old) accounted for most clients with infectious diseases, the infant age group (below 5 years) accounted for clients with congenital malformations, and the middle- and senior-age group (40 years and older) accounted for the majority of clients with circulatory diseases.

Table 3: Numbers and Percentages of Outpatients among the Five Diagnosis Groups (by Age Group)

	<1 year old	1 to 4 years old	5 to 19 years old	20 to 39 years old	40 to 59 years old	≥60 years old
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Injury	1 (0.47)	5 (2.36)	38 (17.9)	99 (46.7)	57 (26.9)	12 (5.66)
Musculoskeletal diseases	0 (0)	0 (0)	5 (5.62)	28 (31.5)	44 (49.4)	12 (13.5)
Infectious diseases	1 (3.45)	5 (17.2)	11 (37.9)	6 (20.7)	4 (13.8)	2 (6.90)
Congenital malformations	8 (32.0)	14 (56.0)	3 (12.0)	0 (0)	0 (0)	0 (0)
Circulatory diseases	1 (4.35)	0 (0)	0 (0)	2 (8.70)	8 (34.8)	12 (52.2)

Comparison between Characteristics of Outpatients and Inpatients

Table 4 lists the results of the comparative analysis between the two groups, which showed significant differences in age and diagnosis (Table 4). Overall, the Outpatient group included a significantly higher number of clients in the 20 - 39 years age group, and in the diagnosis groups of injury, musculoskeletal disease and congenital malformations, than the Inpatient group. In contrast, the Inpatient group included a significantly higher number of clients in the below 5 years age group, and in the diagnosis groups of infectious disease and circulatory diseases, than the Outpatient group.

Table 4: Characteristics of the two Groups and results of Chi-Square Tests

	Outpatient group (n=404)	Inpatient group (n=344)	Chi- Square value	P- value
	n (%)	n (%)		
Age (years)				
<1	11 (2.70)	22 (6.4) [†]	15.6	0.008
1 to 4	32 (7.90)	47 (13.7) [†]		
5 to 19	65 (16.1)	58 (16.9)		
20 to 39	138 (34.2) [†]	94 (27.3)		
40 to 59	115 (28.5)	84 (24.4)		
≥60	43 (10.6)	39 (11.3)		
Diagnosis				
Injury	212 (52.5) [‡]	90 (26.2)	169.2	< 0.001
Musculoskeletal diseases	89 (22.0) [‡]	24 (7.00)		
Infectious diseases	29 (7.20)	115 (33.4) [‡]		
Congenital malformations	25 (6.20) [‡]	6 (1.70)		
Circulatory diseases	23 (5.70)	44 (12.8) [‡]		
Others	26 (6.40)	65(18.9) [‡]		

[†] The adjusted residual values were significantly high among outpatients of one age group (20 to 39 was 2.0) and among inpatients in two age groups (<1 was 2.4, 1 to 4 was 2.5). [‡] The adjusted residual values were significantly high among outpatients of three diagnosis groups (Injury was 7.3, Musculoskeletal disease was 5.7 and Congenital disease was 3.0) and among inpatients in three diagnosis groups (Infection was 9.1, Circulation disease was 3.4 and Others was 5.2).

DISCUSSION

The characteristics of 404 consecutive outpatients receiving PT services were reviewed and compared with those of inpatients. In the Outpatient group, the common diagnosis-related groups and their dominant age groups were injuries in the young age group (20 to 39 years) and musculoskeletal disease in the middle-aged group (40 to 59 years). These two diagnosis-related groups and congenital malformations were significantly more prevalent among the outpatients than the inpatients. The study results supported the proposed hypothesis that medical diagnosis relating to an orthopaedic medical condition in young to middle-aged clients would be dominant among outpatients and that there would be significant differences between outpatients and inpatients. Our findings show the current situation of outpatient PT services in WNB Province. This data provides a rough estimation of potential outpatients PT service needs and could be the base for planning the provision of this service in WNB Province and PNG.

Injury and musculoskeletal disease, the dominant diagnostic groups in the young to middle-aged outpatients, accounted for approximately 75% of all diagnoses in the Outpatient group. They were significantly more prevalent than those in the Inpatient group. These findings were similar to the results of a previous study (Powell, 2001), showing that musculoskeletal pain and orthopaedic problems were common medical conditions, accounting for approximately 55% of all problems in outpatients receiving PT services.

In the current study setting, the outpatient PT services provided for clients with injury and musculoskeletal diseases included not only typical therapeutic exercises but also application of plaster of Paris as a non-operative conservative immobilisation technique for injured limbs due to fractured bones, sprained ligaments, and inflamed and infected soft tissues (Szostakowski et al, 2017). The authors speculated that a large proportion of outpatients with injury musculoskeletal disease might take advantage of the wide-ranging outpatient PT services offered.

According to the Papua New Guinea National Health Plan 2011-2020 (Papua New Guinea Ministry of Health, 2010a), injuries account for 11% of the total burden of disease, while the information on prevalence rates of specific musculoskeletal disease is not available. However, musculoskeletal disease, especially that of the lower back, is reported as one of the leading global causes of disability (GBD 2015 Disease and Injury Incidence and Prevalence Collaborators, 2015), and common

pain conditions affect a large percentage of people in both developed and developing countries (Tsang et al, 2008). Hence, it would be possible to estimate that a potentially large number of people suffer from musculoskeletal disease in Papua New Guinea. The findings of the current study, at least in part, reflect the injury and musculoskeletal disease-related burden in PNG.

Congenital malformations accounted for 6.2% of the diagnosis groups in the outpatient group and were significantly more prevalent in the Outpatient group than in the Inpatient group. Approximately 90% of outpatients with congenital malformations were in the less than 5- years-old age group. Of the 25 outpatients with congenital malformations, CTEV, which is a condition present at birth in which the foot is in a rigid turned-in position (Smythe et al, 2018), was the most dominant specific condition, accounting for 56%.

The incidence rate of CTEV in PNG is relatively high (2.7 per 1000 live births per year) compared with that of a Western country, the UK (0.89–1.24 per 1000 live births per year) (Culverwell and Tapping, 2009). The Ponseti method, a conservative treatment method consisting of serial manipulations and specific casting along with or without an Achilles tenotomy, is generally accepted as the first choice for correction of CTEV and is the most popular approach (Zhao et al, 2014). In the current study setting, physical therapists apply this method to infant outpatients with CTEV, as one part of PT services, this might lead our findings. Congenital malformations, especially for CTEV among children, may be a characteristic health condition referred to outpatient PT services in PNG.

The two diagnosis groups of infectious diseases and circulatory diseases were significantly less prevalent in the Outpatient group than in the Inpatient group. Although the specific reasons for this discrepancy between the two groups are unclear, the authors speculate that several factors relating to accessibility of outpatient PT services, such as each client's physical condition, geographical condition and socioeconomic condition (Urimubenshi and Rhoda, 2011) might contribute to the study results. Further studies are needed to clarify the challenges and difficulties associated with access to outpatient services in Papua New Guinea.

Limitations

The present study has several limitations. First, in terms of the generalisation of the findings, the health-related statistics in each province or district in PNG are different (Papua New Guinea Ministry of Health, 2010b). Thus, the

present findings in WNB Province might not reflect the characteristics of people living elsewhere in PNG. Additional studies that take into account nationwide probability samples are required to better understand the clients' characteristics of outpatient PT service in PNG. Second, it was not possible to gather detailed information on the clients' life in their communities and the provision of PT services locally. To better understand current hospital-based outpatient PT services, further information such as specific barriers or obstacles that hinder clients' participation and integration into their community, specific PT interventions to address a wide range of clients' difficulties, and outpatient service administration, should be examined. Third, PT is one part of rehabilitation services that comprise multi-disciplinary interventions (World Health Organisation Regional Office for the Western Pacific, 2019). Further studies examining collaboration and cooperation between outpatient PT services and other services or professions such as referral mechanisms and strategies for sharing clients' information with other professions, are needed to gain a better understanding of outpatient PT services in PNG.

CONCLUSION

We investigated the characteristics of 404 consecutive outpatients receiving PT services have been described. The findings indicated that injury in the young age group (20 to 39 years old) and musculoskeletal diseases in the middle-aged group (40 to 59 years old) were the most common diagnosis groups among them. These two diagnosis groups and congenital malformations were significantly more prevalent among the outpatients than the inpatients. The study findings provide information on current situation for outpatient PT services and allow us to make rough estimation of the potential service needs of outpatient PT services. These findings would form an important basis for planning of outpatient PT services in WNB Province and PNG.

ACKNOWLEDGEMENT

The authors are grateful to all the clients who participated in the study by providing their data. They thank Mr. Lindsay Pumpara for his excellent technical assistance and the West New Britain Health Authority and Kimbe Provincial Hospital for their invaluable support.

REFERENCES

- Berg D (1976). An approach to the rehabilitation of the injured. *P N G Med J*; 19: 212-219. <https://doi.org/10.3131/jvsj.19.212>
- Brogan J (1982). The physiotherapist in Papua New Guinea. *P N G Med J*; 25: 186-188.
- Culverwell AD, Tapping CR (2009). Congenital talipes equinovarus in Papua New Guinea: a difficult yet potentially manageable situation. *Int Orthop*; 33: 521-526. <https://doi.org/10.1007/s00264-007-0511-x>. PMID:18196240 PMCID:PMC2899095
- GBD 2015 Disease and Injury Incidence and Prevalence Collaborators (2016). Global, regional, and national incidence, prevalence, and years lived with disability for 310 diseases and injuries, 1990–2015: A systematic analysis for the global burden of disease study 2015. *Lancet*; 388: 1545-1602. [https://doi.org/10.1016/S0140-6736\(16\)31678-6](https://doi.org/10.1016/S0140-6736(16)31678-6).
- Jubilee Australia (2018). Double or nothing. The broken economic promises of PNG LNG [Online]. Available at: <https://www.jubileeaustralia.org/latest-news/new-jubilee-report-shows-that-efic-funded-png-lng-project-has-hurt-png>. [Accessed on 13 Jan 2019]
- Karthikeyan P, Ramalingam KP (2014). Physiotherapy training to enhance community-based rehabilitation services in Papua New Guinea: An educational perspective. *Asia Pacific Disability Rehabilitation Journal*; 25: 82-94. <https://doi.org/10.5463/dcid.v25i1.259>.
- National Statistical Office PNG (2015). Papua New Guinea 2011 National report. Waigani, Papua New Guinea National Statistical Office [Online]. Available at: <http://actnowpng.org/sites/default/files/2011%20Census%20National%20Report.pdf>. [Accessed on 2 Jan 2019]
- Papua New Guinea Ministry of Health (2010a). National Health Plan 2011-2020. Volume 1 Policies and Strategies [Online]. Available at: <https://www.health.gov.pg/subindex.php?acts=1>. [Accessed on 17 Apr 2019]
- Papua New Guinea Ministry of Health (2010b). National Health Plan 2011-2020. Volume 2 (Part A, Part B) Reference data and national health profile [Online]. Available at: <https://www.health.gov.pg/subindex.php?acts=1>. [Accessed on 17 Apr 2019]
- Powell N (2001). Physiotherapy in Mount Hagen General Hospital: An audit of activity over a six-month period. *P N G Med J*; 44: 24-35.
- Saito T, Bai A, Matsui N, Izawa KP, Watanabe S, Malagisa A (in press). A retrospective observational study reviewing characteristics of inpatients receiving rehabilitation services at a single provincial hospital in West New Britain Province, Papua New Guinea.
- Szostakowski B, Smitham P, Khan WS (2017). Plaster of Paris - short history of casting and injured limb immobilization. *Open Orthop J*; 11: 291-296. <https://doi.org/10.2174/1874325001711010291>. PMID:28567158 PMCID:PMC5420179
- The World Bank (2019). Papua New Guinea [Online]. Available at: <https://data.worldbank.org/country/papua-new-guinea>. [Accessed on 13 Dec 2018]
- Tsang A, Von Korff M, Lee S, Alonso J, Karam E, Angermeyer MC, Borges GLG, Bromet EJ, Demyttenaere K, de Girolamo G, de Graaf R, Gureje O, Lepine J-P, Haro JM, Levinson

D, Oakley Browne MA, Posada-Villa J, Seedat S, Watanabe M (2008). Common chronic pain conditions in developed and developing countries: gender and age differences and comorbidity with depression-anxiety disorders. *J Pain*; 9: 883-891. <https://doi.org/10.1016/j.jpain.2008.05.005>. PMID:18602869

Urimubenshi G, Rhoda A (2011). Environmental barriers experienced by stroke patients in Musanze district in Rwanda: A descriptive qualitative study. *Afr Health Sci*; 11: 398-405.

World Confederation of Physical Therapy (2019). Papua New Guinea: A profile of the profession [Online]. Available at: <https://world.physio/membership/papua-new-guinea>. . [Accessed on 13 Nov 2020]

World Health Organisation (2014). World health statistics 2014 [Online]. Available at: http://www.who.int/gho/publications/world_health_statistics/2014/en/. [Accessed on 2 Jan 2019]

World Health Organisation (2016). Papua New Guinea-WHO country cooperation strategy 2016-2020 [Online]. Available at: <https://www.who.int/countries/png/en/>. [Accessed on 2 Jan 2019]

World Health Organisation (2019). ICD-10 online version [Online]. Available at: <https://www.who.int/classifications/icd/icdonlineversions/en/>. [Accessed on 17 Apr 2019]

World Health Organisation Regional Office for the Western Pacific (2019). Western Pacific Regional framework on rehabilitation [Online]. Available at: <https://iris.wpro.who.int/handle/10665.1/14344>. [Accessed on 13 Jan 2019]

Zhao D, Liu J, Zhao L, Wu Z (2014). Relapse of clubfoot after treatment with the Ponseti method and the function of the foot abduction orthosis. *Clin Orthop Surg*; 6: 245-252. <https://doi.org/10.4055/cios.2014.6.3.245>. PMID:25177447 PMCID:PMC4143509