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Trends in Length of Stay: Experience From a Tertiary Care Pediatric Rehabilitation Unit in Saudi Arabia.

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Trends in Length of Stay: Experience From a Tertiary Care Pediatric Rehabilitation Unit in Saudi Arabia.

Abstract

Background: Pediatric rehabilitation units offer unique challenges due to complex rehabilitation needs of children based on their age group and diagnosis. Length of stay (LOS) is an indirect measure of hospital cost and efficiency of a clinical service and it is important to determine the factors affecting LOS in hospitalized children undergoing inpatient rehabilitation. **Methods:** Record of 350 children (males: 222, female: 128) who underwent inpatient pediatric rehabilitation program at King Fahad Medical City, Riyadh Saudi Arabia during 2011 to 2018 were reviewed. Diagnoses were categorized into cerebral palsy, spinal cord injury, traumatic brain injury, non-traumatic brain injury and others. Variables such as age, gender, diagnosis, home location, and length of hospital stay were analyzed. Median (25th – 75th quartiles) are reported for non-normally distributed quantitative variables. **Results:** Most children admitted for rehabilitation had diagnoses of cerebral palsy (40%) and traumatic brain injury (22%). The median LOS was 39.5 (28.75 – 56) days, patients with spinal cord injuries had a significantly higher LOS 46 (30 – 72) days. Two-thirds of the children were from outside the Riyadh region. Cerebral palsy patients were significantly younger in age 6 (5 – 9) years as compared to other diagnoses. Traumatic brain injury was prevalent significantly in males ($p=0.018$), whereas female patients had a significantly higher non-traumatic brain injury ($p=0.018$). Spearman Rho Correlation results depicted a weak but significant positive relationship between LOS and age ($\rho=0.142$, $p=0.018$). **Conclusion:** LOS of children undergoing inpatient rehabilitation varies according to the diagnosis, age, gender, and home location. LOS may be reduced by adapting strategies based on these measures.

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ABSTRACT

Background: Pediatric rehabilitation units offer unique challenges due to complex rehabilitation needs of children based on their age group and diagnosis. Length of stay (LOS) is an indirect measure of hospital cost and efficiency of a clinical service and it is important to determine the factors affecting LOS in hospitalized children undergoing inpatient rehabilitation. **Methods:** Record of 350 children (males: 222, female: 128) who underwent inpatient pediatric rehabilitation program at King Fahad Medical City, Riyadh Saudi Arabia during 2011 to 2018 were reviewed. Diagnoses were categorized into cerebral palsy, spinal cord injury, traumatic brain injury, non-traumatic brain injury and others. Variables such as age, gender, diagnosis, home location, and length of hospital stay were analyzed. Median (25th – 75th quartiles) are reported for non-normally distributed quantitative variables. **Results:** Most children admitted for rehabilitation had diagnoses of cerebral palsy (40%) and traumatic brain injury (22%). The median LOS was 39.5 (28.75 – 56) days, patients with spinal cord injuries had a significantly higher LOS 46 (30 – 72) days. Two-thirds of the children were from outside the Riyadh region. Cerebral palsy patients were significantly younger in age 6 (5 – 9) years as compared to other diagnoses. Traumatic brain injury was prevalent significantly in males ($p=0.018$), whereas female patients had a significantly higher non-traumatic brain injury ($p=0.018$). Spearman Rho Correlation results depicted a weak but significant positive relationship between LOS and age ($\rho=0.142$, $p=0.018$). **Conclusion:** LOS of children undergoing inpatient rehabilitation varies according to the diagnosis, age, gender, and home location. LOS may be reduced by adapting strategies based on these measures.

Keywords: length of stay, pediatrics, rehabilitation, outcome measures, Saudi Arabia, disability

INTRODUCTION

Length of stay (LOS) is considered to be one of the performance indicators in a hospital setting. It provides information on main sources of hospital costs and is considered an indicator for efficiency of inpatient care. In medical rehabilitation, it is used as a rehabilitation outcome measure. It has been reported that early and intensive rehabilitation in an inpatient setting leads to shorter length of stay and improved functional outcomes.^{1,2} There is paucity of data regarding LOS of inpatient pediatric rehabilitation (IPR) programs. Similarly, information on factors affecting duration of hospitalization for pediatric patients undergoing IPR is very limited.^{3,4} Rehabilitation LOS and functional change vary according to diagnosis during pediatric IPR;^{3,5} however, specific data pertaining to the Saudi population has not been reported in the literature. Data regarding the epidemiology of pediatric disability is lacking as well.

The pediatric rehabilitation program at King Fahad Medical City (KFMC), Riyadh, is the only ministry of health rehabilitation program in the Kingdom of Saudi Arabia (KSA) offering comprehensive inpatient rehabilitation care for children and adolescents across the country. Given the lack of comprehensive rehabilitation services in KSA, families and stakeholders prefer to seek specialized rehabilitation care for their patients at KFMC. Subsequently, referral load, waiting time to be seen, admission waiting time, and LOS is affected. Since community based specialized pediatric rehabilitation is scarce, the inpatient hospital stay is utilized to accommodate for the needs of patients and families, which could be otherwise ensured in the community if services were available. This in turn could impact the LOS. Hence, it remains important to highlight the LOS during pediatric inpatient rehabilitation. It will help to identify the need of resource allocation and bring attention to strategize pediatric rehabilitation services at national level.

This article briefly describes the hospital LOS in correlation with epidemiological and diagnostic characteristics of children undergoing IPR at a tertiary care rehabilitation facility in KSA.

METHODOLOGY

Setting

Inpatient pediatric rehabilitation (IPR) unit at the Rehabilitation Hospital of KFMC Riyadh, KSA is a 14-bed unit which offers comprehensive integrated rehabilitation program and receives referrals from across the country. It is accredited by the Commission on Accreditation of Rehabilitation Facilities (CARF). The core services include pediatric physical therapy, occupational therapy, and speech therapy along with rehabilitation nursing and physiatry. The Rehabilitation Hospital at KFMC is the largest Ministry of Health rehabilitation facility in KSA. As a tertiary care facility, medical, surgical and intensive care services to patients undergoing rehabilitation are provided by relevant pediatric departments.

Participants

All children (N=350) aged 4-16 years who were admitted to the pediatric IPR unit from 2011 to 2018 were included in this study. Patients who did not complete their rehabilitation program including those who were transferred to acute care, died, or were discharged against medical advice were excluded from the study. The pediatric IPR program provides services to patients of the pediatric age group (4-12 years) and adolescent age group (13-16). Patients older than 16 years are treated within adult rehabilitation programs as per hospital policy. Children younger than 4 years receive rehabilitation services during their admission in acute care followed by outpatient services. This study was approved by the Institutional Review Board.

Data Collection

A retrospective chart review was carried out for all patients included in the study. Data extracted from medical records included age, sex, home location (inside or outside Riyadh), diagnosis, and the LOS of IPR. The data was collected from electronic medical records by two physical medicine and rehabilitation physicians who cross verified the data. The diagnoses were categorized as cerebral palsy (CP), spinal cord injury (SCI), traumatic brain injury (TBI), non-traumatic brain injury (N-TBI) and others. SCI was not classified as traumatic or non-traumatic SCI due to rarity of patients with non-traumatic SCI. "Others" included rare diagnosis of admission: developmental dysplasia of hip, idiopathic scoliosis, osteogenesis imperfecta, arthrogyrosis multiplex, genetic disorders, muscular dystrophy, neurofibromatosis, hereditary ataxia, and amputations.

Data Analysis

The data was entered and analyzed using IBM SPSS 26. Normality of the quantitative variables (age and length of stay) was assessed using one-sample Kolmogorov Smirnov Test. Non-normally distributed quantitative variables are expressed as Median (25th – 75th quartiles). Frequencies and percentages are reported for qualitative variables (gender, age-groups, region, and diagnosis). Pearson-Chi square was applied to observe the association of diagnosis with age-groups, gender, and region. Post-Hoc test was applied in-case of significant chi-square values, the adjustment to the significance levels for this test was done using the Bonferroni adjustment. Kruskal Wallis H test was used to observe median differences of diagnosis with age and length of stay. Mann-Whitney U test was applied to carry out the Post-Hoc analysis using Tukey's adjustment to the significance level. Spearman Rho Correlation was applied to find the relationship between age and length of stay. After fulfilling the assumptions, the Poisson regression analysis was performed to predict

the length of stay from gender, diagnosis, age and region. Goodness of Fit tests and Model tests for all regression analysis were significant. An $\alpha=0.05$ was considered as statistically significant.

RESULTS

Majority of the patients were admitted from outside Riyadh region 218 (62.3%) which was common to all diagnoses. Male patients were higher in number 222 (63.4%) as compared to the females 128 (36.6%). Most of the patients admitted for IPR had diagnosis of CP 140 (40%) and TBI 77 (22%). A significant association was observed between age and diagnosis ($p<0.001$). Post-Hoc Chi-square test revealed that CP patients had a significantly lower age ($p<0.001$) as compared to the other diagnoses. Gender and diagnosis were also significantly associated ($p=0.016$). Post-Hoc Chi-square test showed that Traumatic Brain Injury was prevalent significantly in males ($p=0.018$) as compared to females, whereas female patients had a significantly higher Non-Traumatic Brain Injury ($p=0.018$) as compared to males. However, no significant association was observed between region and diagnosis ($p=0.954$). Results are presented in table 1. The overall median age significantly differed with diagnosis ($p=0.009$); results of post-hoc Tukey's test showed that patients with CP had a significantly lower median age 6 (5-9) years as compared to the median ages in other diagnosis ($p<0.05$) respectively. The median LOS varied between 28.75–56 days, whereas the median LOS significantly differed among diagnosis ($p<0.001$).

Table 1. Association of Demographic Characteristics with Diagnosis using Pearson Chi-square.

	Diagnosis n (%)						p-value
	CP n = 140 (40%)	TBI n = 77 (22%)	N-TBI n = 54 (15.4%)	SCI n = 57 (16.3%)	Others n = 22 (6.3%)	Total 350 (100%)	
Age Groups							
4-12	125 (89.3)†	51 (66.2)	37 (68.5)	31 (54.4)	11 (50.0)	255 (72.9)	<0.001*
13-16	15 (10.7)	26 (33.8)	17 (31.5)	26 (45.6)	11 (50.0)	95 (27.1)	
Gender							
Female	50 (35.7)	17 (22.1)	26 (48.1)†	25 (43.9)	10 (45.5)	128 (36.6)	0.016*
Male	90 (64.3)	60 (77.9)†	28 (51.9)	32 (56.1)	12 (54.5)	222 (63.4)	
Region							
Riyadh	51 (36.4)	28 (36.4)	21 (38.9)	24 (42.1)	8 (36.4)	132 (37.7)	0.954
Outside Riyadh	89 (63.6)	49 (63.6)	33 (61.1)	33 (57.9)	14 (63.6)	218 (62.3)	

CP: Cerebral Palsy, TBI: Traumatic Brain Injury, N-TBI: Non-Traumatic Brain Injury, SCI: Spinal Cord Injuries; *statistically significant at 5% level of significance; † Age group of 4-12 years in patients with CP significantly differs from (TBI, N-TBI, SCI, Others), post-hoc multiple comparisons were applied using chi-square test; ‡ Diagnosis differs among males and females, post-hoc multiple comparisons applied using chi-square test.

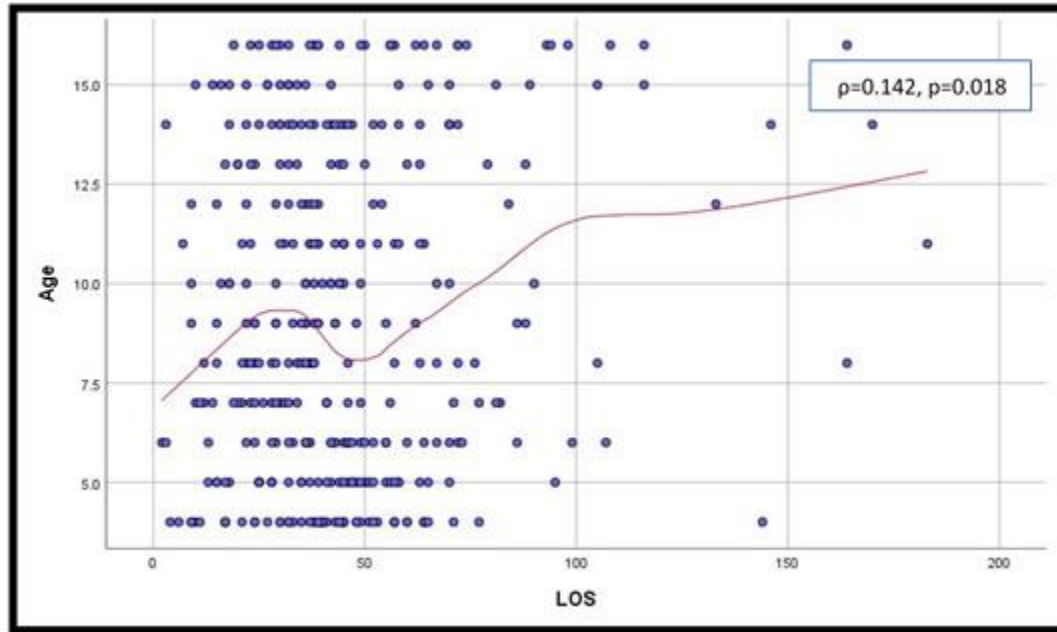
Post-hoc Tukey's test showed that the patients with Spinal Cord Injury had a significantly higher LOS 46 (30 – 72) days as compared to other diagnoses days with $p<0.05$, respectively (Table 2). Spearman Rho Correlation results depicted a weak but significant positive relationship between LOS and Age ($\rho=0.142$, $p=0.018$), results are presented in Figure 1.

Table 2. Comparison of LOS and AGE with Diagnosis using Kruskal-Wallis H Test

	CP Median (25 th -75 th Quartile) n=140	TBI Median (25 th -75 th Quartile) n=77	N-TBI Median (25 th -75 th Quartile) n=54	SCI Median (25 th - 75 th Quartile) n=57	Others Median (25 th -75 th Quartile) n=22	p-value
LOS	38 (25-47.5)**	45 (28.5-65)**	38.5 (30-52.75)**	46 (30-72)	36.5 (25-46)**	<0.001*
AGE	6 (5-9)	10 (6-14)**	10.5 (6-13.25)**	12 (8-15)**	11.5 (6.75-14.25)**	0.009*

LOS: Length of Stay, CP: Cerebral Palsy, TBI: Traumatic Brain Injury, N-TBI: Non-Traumatic Brain Injury, SCI: Spinal Cord Injuries; *statistically significant at 5% level of significance; **significant multiple comparisons (CP with TBI, N-TBI, SCI, OTHERS) and (SCI with CP, TBI, N-TBI, OTHERS) obtained using Mann-Whitney U test.

Figure 1. Spearman Rho Correlation between Length of Stay and Age.



The Poisson regression results showed that, patients with N-TBI had 20.5% more chances to have an increased LOS ($p < 0.001$), whereas it was 57.6% for patients with SCI ($p < 0.001$). Patients with TBI were 20.7% more likely to have an increased LOS ($p < 0.001$). The regression-relation between CP and LOS was not significant ($p = 0.624$). Similarly, with 1-year increase in age, the LOS increased by 0.9% ($p < 0.001$). Patients living inside Riyadh region had significantly less LOS ($p = 0.038$) as compared to patients visiting from outside Riyadh region. Female patients had a significantly less LOS as compared to male patients ($p < 0.001$). Results are presented in Table 3.

Table 3. Poisson Regression – gender, age and diagnosis predicting the length of stay.

	β	S.E	Exp (β)	p-value
^a Region Riyadh	-0.034	0.0425	0.966	0.038*
^b Gender Females	-0.168	0.0173	0.846	<0.001*
^c Diagnosis Cerebral Palsy	0.019	0.0021	1.019	0.624
Non-Traumatic Brain Injury	0.187	0.0401	1.205	<0.001*
Spinal Cord Injury	0.455	0.0386	1.576	<0.001*
Traumatic Brain Injury	0.188	0.0386	1.207	<0.001*
Age	0.009	0.0021	1.009	<0.001*

Dependent variable = Length of Stay; Reference Category (^aoutside Riyadh, ^bmales, ^cOthers); *statistically significant at 5% level of significance; S.E = Standard Error; β = Coefficient Estimates; Exp (β) = Exponentiated Values

DISCUSSION:

This study provides demographic overview and LOS of children who underwent an IPR program at a tertiary care rehabilitation facility in KSA. In 2016, a demographic survey by general authority for statistics reported that the total population of KSA is around 31 million with 30.4% of population younger than 15 years of age. (6) The prevalence rate of disability in KSA is 3326 per 100,000 populations (3.3%) with 1.8% in the age range of 1-4 years [6]. As compared to the countries like Australia and the United States, which have the highest disability rates in children (7.0% -10.4%) [7], the prevalence of pediatric disability in KSA is less; however, there is a considerable lack of

reliable statistics. Since there is a long tradition of consanguineous marriages in the Middle Eastern countries, the actual prevalence of childhood disability may be more than what is reported [8]. The prevalence of male and female disability in KSA was reported to be 58.5% and 41.5% respectively. This corresponds to the male-to-female ratio in general population of KSA [6]; however, our study reports a slightly higher average percentage of males (63.4%) undergoing inpatient rehabilitation, with male predominance across all diagnoses. (Table 1). This may be attributed to fewer number of patients having diagnosis with genetic disorders in our study. Also, the scope of service for IPR programs is limited and generally would not include patients with only intellectual or learning disabilities. Traumatic Brain Injury was prevalent significantly in males whereas female patients had a significantly higher Non-Traumatic Brain Injury

The mean age was 9.1 years in this study. Two hundred and fifty-five (72.9%) patients were in 4-12 years age range, while 95 patients (27.1%) were in 13-16 years age range. This corresponds with bed allocation in our IPR program, where 4 out of total 14 beds (28%) were allocated to adolescent age group. This arrangement was to ensure compliance with hospital policies and logistics. The age-ranges were variable across various diagnoses with 89.3% of patients with CP in the age group of 4-12 years. SCI remains a diagnosis of adolescents and young adults in the country, as 45.6% of the children with SCI were in the age group of 13-16 years (Table 1).

Riyadh is the capital city of KSA and hosts the largest population in the country.⁶ Pediatric rehabilitation program at KFMC Riyadh is the only ministry of health rehabilitation program in the KSA offering comprehensive IPR care for children and adolescents across the Kingdom. All regions of the country were not included in this study, as the objective was to know the number of patients admitted from outside Riyadh region. This is important in the Saudi health system, as the financial burden of patients admitted from distant locations is more than local admissions. In addition to medical care, various services are offered by the government including traveling expenses for appointments and the delivery of medical equipment and medications to homes of patients. Families prefer to rely on tertiary care specialized hospitals even for primary care needs including medication refills or minor procedures. This has to be taken in context that many pediatric disabilities require long term or lifelong specialized care. Since a considerable majority of patients (62.3%) in this study were from outside Riyadh, this renders the need of developing IPR services in other regions. The majority of rehabilitation services in the country are outpatient based, and the inpatient allocation of rehabilitation beds are fairly limited [9]. This may be reflected in relatively longer LOS (45 days) as compared to other reports,^{4,5,10} as children coming from underserved areas may be kept longer to ensure optimal outcomes and safe discharges. Families often request to extend the LOS in the hope to achieve more during inpatient stay due to their reservations on rehabilitation services in their local regions. This requires frequent team reviews, extensive family education, counseling and involvement of social services to ensure continuity of care; however, this prolongs waiting time for admissions, and prompts admitting psychiatrists to be cautious of admission criteria. The private sector is showing interest in IPR, which may help to address the need in some regions. Considering that there is an unmet need of adult rehabilitation across the country, there is a possibility that pediatric rehabilitation may remain underemphasized for some time. Additionally, there is limited local data reporting the functional or long-term outcomes of children undergoing inpatient rehabilitation programs.

In the present study, CP contributed the highest number of patients 140 (40.0%) in total with mean age of around 7.3 years. Majority of patients with CP were males (64.3%) and were from outside Riyadh region (63.6%). These findings were consistent with one multicenter study in Istanbul, Turkey in which 730 patients had mean age of 7.27 years with a 1.4:1 male predominance.¹¹ Length of stay for children with CP undergoing IPR program was 38 days as compared to other studies showing a LOS of 51 days and 22 days respectively.^{12,13} The variation in LOS of children with CP may depend upon multiple factors including scope of service, age, payer, and sector of service (public or private). Since children with CP have complex medical needs, they need to be hospitalized more often as compared to the general pediatric population, have longer LOS, require more procedures during admission, and have an overall increase in financial burden.¹⁴ Sometimes, IPR programs may have to accommodate children with CP even when a comprehensive rehabilitation program is not required at the time of admission. For example, patients may be admitted for surgical procedures like gastrostomy, orthopedic surgeries, and dental procedures. It becomes challenging when the primary service may not have day care or admission services for such procedures and patients are from a remote region. The patients can avail some rehabilitation services during such admissions and the rehabilitation team gets an opportunity to review the rehabilitation needs and optimize care. Children with CP coming from remote areas who require a well-coordinated comprehensive care are admitted to facilitate optimal services within reasonable time. This in turn has collateral effects, as there are increasing referrals to tertiary care facilities for rehabilitation services; while the development of specialized pediatric rehabilitation services outside main cities remains fairly limited.

Although SCI is uncommon in children with less than 4% annual incidence, it increases with increasing age with peak incidence at 16-30 years [15]. This is similar to previous studies in KSA, which reported a higher prevalence in males and young adults aged 16-40 years, with motor vehicle accidents as the most common cause of SCI in adults.¹⁶⁻¹⁸ The etiology of pediatric SCI is not documented in KSA; however, all-terrain vehicle contracted injuries are reported to have a higher rate in the pediatric population than adults in a systemic review.¹⁵ Similar to other studies, this study also observed male predominance (56.1%) in pediatric SCI [8]. The median LOS was the highest among all diagnoses (46 days); which is less as compared to previous studies done on adults with SCI in KSA,¹⁶⁻¹⁹ but comparatively longer as compared to other reports.^{4,19,20}

Twenty-two percent of the children in the study were admitted with TBI. These children had a mean age of 9.8 years, and there were 3.5 times as many males as females (77.9% versus 22.1%, respectively). One observational prospective study conducted from 2012 to 2014 in a pediatric acute setting also documented a higher frequency (62.9%) of males.²¹ Rice et al reported that LOS in children with TBI is directly proportional to severity of TBI.²² A recent literature review indicates that falls and sports are the most common cause of TBI in toddlers and older children²³; however, the etiology needs to be further explored in children with TBI in KSA. Our study reports a shorter median LOS (45 days) as compared to LOS for TBI in adults in KSA.²⁴ Non-Traumatic Brain injuries (N-TBI) and "other" diagnoses constituted 15% and 6% of patient population in this study respectively. The median LOS for children with TBI was slightly more than the median LOS for N-TBI diagnosis.

Certain trends in LOS based on diagnosis were observed in this study which can help to structure the scope of local pediatric rehabilitation programs and come up with prediction models. As shown in our study, CP remains the youngest population being admitted for IPR. There is lack of updated data on prevalence of CP in KSA. A report from 2011 estimated the prevalence of CP in KSA to be 23.4/10000 Saudi Children.²⁵ This also demonstrates that there is a lack of information on burden of care to handle the long-term rehabilitation needs of children with CP. Increase in age demonstrated trend towards increased LOS in our study. The likelihood that older children will stay longer can help to come up with strategies to address the factors requiring longer stay. Similarly, various diagnostic groups showed statistically significant possibility of increased LOS including SCI, TBI and N-TBI. Similar to adult service, a diagnosis based specialized pediatric rehabilitation program can help to address the specialized needs of children with particular diagnosis and may help in decreasing the LOS. The concept of specialized pediatric programs based on diagnosis is still primitive in the country. Though efforts are being carried out to improve services in tertiary care facilities; the lack of awareness and resources in the community setting remains a barrier to ensure continuity of rehabilitation care.

The care of admitted children with pediatric disabilities in ministry of health centers is funded by the government. The LOS is defined by the treating team; however, it is monitored as an institutional key performance indicator. Since there are no other MOH facilities offering specialized pediatric inpatient rehabilitation services, this study will help to set local bench marks. There is growing interest of governmental and private stakeholders towards engaging private third-party payers; however, structured systems to address the financial aspects of pediatric disability care coverage are still lacking. Given the long-term care of children with pediatric disability; there is a dire need of development in this sector.

The results of the study provide data which could help to identify the rehabilitation needs of children in the country. It advocates the inclusion of disability needs of children in health policies and national strategic planning. Children with CP, who generally do not require inpatient rehabilitation in the developed health systems, constitute the majority of patients who were admitted for inpatient rehabilitation. This reflects a considerable gap in care of children with CP. Specific ambulatory programs for children with CP need to be introduced across all regions of KSA, which can be adapted by introducing policies to mandate regional CP programs. Introduction of such programs will also highlight the importance and need of disability care for children in general. Strengthening of rehabilitation services locally can provide opportunity for patients with other diagnoses. Similarly, this is also relevant to children with SCI, which had the longest LOS in our study. Inpatient rehabilitation services are integral to care of individuals with SCI, especially during acute and subacute phase, followed by ambulatory care and long-term liaison with a rehabilitation institute. Trauma centers across the country need to introduce pediatric SCI services catering to their inpatient and outpatient needs. Since 62.3% of admitted patients were from outside Riyadh city, there remains a deficit in availability of local rehabilitation services, putting financial and resource constraint on specialized centers. The development of pediatric rehabilitation services across the country requires advocacy and legislation at higher level. Findings from this study can serve as a reference in developing strategies to optimize rehabilitation care of children with disabilities.

Limitations

The report has certain limitations. It does not include details on etiology and severity of injury in brain or spinal cord injuries. Also, duration from onset to rehabilitation admission was not included. Future research on functional status at admission and discharge may provide valuable information in developing rehabilitation strategies for children with disabilities requiring IPR in KSA.

CONCLUSION

LOS of children undergoing inpatient rehabilitation varies according to the diagnosis, age, gender, and home location. LOS may be reduced by adapting strategies based on these measures. The need of rehabilitation in regions other than Riyadh should be ascertained. Future studies need to be carried out on specific diagnosis with focus on change in functional status, onset of illness, disease severity and socioeconomic factors.

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