original article

Variation in access to pediatric surgical care among coexisting public and private providers: inguinal hernia as a model

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BACKGROUND: Faced with growing healthcare demand, the Saudi government is increasingly relying on privatization as a tool to improve patient access to care. Variation in children's access to surgical care between public (PB) and private providers (PV) has not been previously analyzed.
OBJECTIVES: To compare access to pediatric surgical services between two coexisting PB and PV.
DESIGN: Retrospective comparative study.
SETTINGS: A major teaching hospital and the largest PV group in Saudi Arabia.
PATIENTS AND METHODS: The outcomes for children who underwent inguinal herniotomy (IH) between May 2010 and December 2014 at both providers were with IH serving as the model. Data collected included patient demographics, insurance coverage, referral pattern and access parameters including time-to-surgery (TTS), surgery wait time (SWT) and duration of symptoms (DOS).
MAIN OUTCOME MEASURE(S): TTS, SWT and DOS.
RESULTS: Of 574 IH cases, 56 cases of in-hospital referrals were excluded leaving 290 PB and 228 PV cases. PV patients were younger (12.0 vs 16.4 months, *P*=.043) and more likely to be male (81.6% vs 72.8%, *P*=.019), expatriates (18% vs 3.4%, *P*<.001) and insured (47.4% vs 0%, *P*<.001). The emergency department was more frequently the source for PB referrals (35.2% vs 12.7%, *P*<.001) while most PV patients were self-referred (72.8% vs 16.7%, *P*<.001). Access parameters were remarkably better at PV: TTS (21 vs 66 days, *P*<.001), SWT (4 vs 31 days, *P*<.001) and DOS (33 vs 114 days, *P*<.001).
CONCLUSION: When coexisting, PV offers significantly better access to pediatric surgical services compared to PB. Diverting public funds to expand children's access to PV can be a valid choice to improve access to care in case when outcomes with the two providers are similar.
LIMITATIONS: Although it is the first and largest comparison in the pediatric population, the sample may not represent the whole population since it is confined to a single selected surgical condition.

Access to care ideally entails the provision of the right health service at the right time in the right place.[1,2] Poor access is associated with longer waiting times for elective surgical procedures and consequently a negative perception of care and raised level of anxiety.[3] The rising demand on healthcare services globally is outpacing the public sector's capacity, promoting private provider growth as an effective alternative to improve access and meet the population demand.[4-6] We have recently demonstrated that privatization can significantly improve the access in adult elective surgical care;[7] however, we do not know if private providers can similarly offer better access to pediatric surgical care compared with public providers.

We selected inguinal herniotomy (IH) as one of the most frequent surgical interventions during infancy and childhood.[8] Inguinal hernia affects 3.5% to 5% of all full-term infants and 9% to 11% of premature babies.[9] IH is access sensitive, as delays in repair are associated with a high risk of incarceration, which can reach up

to 30% in infants.[10] Moreover, delay in IH particularly for premature babies is linked to more difficult repairs, higher risks of incarceration and the risk of testicular atrophy.[11-13]

Prompt and proper management necessitates adequate access to care which is considered a major measure of healthcare quality in general.[14,15] Our group and others have demonstrated that variation in a child's access to pediatric surgical care can significantly influence both the processes and outcomes in managing various surgical conditions including Hirschsprung disease,[16] gastroschisis,[17] appendicitis[18] and hernias.[19]

Previous comparisons of pediatric surgical care access used different geographic populations or different healthcare systems. However, comparing coexisting different providers that compete on the same population pool could be a more valuable tool in assessing the impact of healthcare privatization in a defined geographic area. In this study we compare access to IH surgery between a private-for-profit provider (PV) and a public provider (PB) serving the same geographic population.

PATIENTS AND METHODS

Providers

We've selected two major PB and PV serving the same geographic population in Riyadh, the largest city in Saudi Arabia with an estimated population of around six million, 35% of whom are children.[20]

King Khalid University Hospital (KKUH) is a PB and among the largest university affiliated hospitals in Saudi Arabia and one of the largest contributors to scientific medical research in the country.[21,22] On the private side, we selected three PVs that are part of the Dr. Suliman Al Habib Medical Group (HMG). HMG is the country's largest network of hospitals operating more than 10 medical facilities in the Middle East and Africa.[23] Both providers shared similar aggregate bed capacity during the study period;[24,25] however, they differ in access. KKUH as a PB has an open access policy to all Saudi nationals, affiliated university staff and students, while HMG access is restricted to insured patients or those who can afford out-of-pocket medical expenses. The project was approved by both institutes' ethical committees and assigned a protocol number (E-14-1368).

Patient cohorts

Records of all children under the age of 14 who underwent IH by both providers between May 2010 and December 2014 were reviewed. We excluded in-hospital cases referred directly from neonatal intensive care, those diagnosed during an admission for other medical conditions and those who underwent herniotomy concurrently with another primary surgical procedure, due to the expected significant confounders in their referral patterns compared to the general population.

Assessed outcomes

Three primary outcomes were used in our model to assess patients access to care: time-to-surgery (TTS, calculated from the onset of hernia detection by the child's guardian to the date of pediatric surgeon's visit; surgery wait time (SWT), the period the patient waited from the date of pediatric surgeon's visit to the date of surgery; and duration of symptoms (DOS), the period from the onset of symptoms to the date of surgery. Correlated variables included patient age, gender, hernia sides, nationality, and type of coverage. Other access confounders were also documented including source of referral to pediatric surgeon, whether patients were followed up for other medical reasons and history of incarceration before surgery.

Statistical methods

Age, TTS, SWT, and DOS were expressed as medians and interquartile ranges then compared using a Mann-Whitney test as they were not normally distributed. Other categorical variables were summarized within each provider as frequencies (percentages), and compared using a chi-squared test. Differences in TTS, SWT and DOS were also explored using linear regression. As these variables were positively skewed and the assumptions of normality of residuals were violated for linear regression models using the raw duration data, the variables were log transformed prior to modelling. The models were used to determine whether significant differences in access time exist between the PB and PV after controlling for potential confounders (age, sex, nationality, referred by, history of incarceration and followed up for other reason). All tests were two-sided and P values of <.05 were considered statistically significant. Analysis was conducted using SPSS version 22 (IBM, Armonk, NY, USA).

RESULTS

Demographics

Of 574 records of IHs reviewed at both providers during the study period, we excluded 56 cases from both groups for the reasons listed in **Table 1**. The demographics of the remaining 290 PB and 228 PV cases are shown in **Table 2**. Private care was more likely in the treatment of slightly younger children, with a higher

Table 1. Excluded cases.

	Public	Private
Direct NICU referral	23	16
Other in-hospital referral	5	7
Combined major procedures	0	5

Table 2. Patient demographics.

	Public (n=290)	Private (n=228)	*P* value
Median age (Interquartile)	16.4 months (3.6-49.9)	12.0 months (2.4-46.3)	.043
Sex			
Boys	211 (72.8%)	186 (81.6%)	.019
Girls	79 (27.2%)	42 (18.4%)	
Hernia sides			
Right	142 (49.0%)	106 (46.5%)	.215
Left	106 (36.6%)	98 (43.0%)	
Bilateral	42 (14.5%)	24 (10.5%)	
Nationality			
Saudi	280 (96.6%)	187 (82.0%)	<.001
Expatriate	10 (3.4%)	41 (18.0%)	
Coverage			
Public	287 (99.0%)	0	<.001
Insurance	0	108 (47.4%)	
Out of pocket	3* (1.0%)	120 (52.6%)	

*Limited private center at public hospital

Table 3. Access characteristics.

Referred by	Public (n=290)	Private (n=228)	
Emergency department	99 (35.2%)	29 (12.7%)	<.001
Other physicians	135 (48.0%)	33 (14.5%)	
Self-referral	47 (16.7%)	166 (72.8%)	
History of incarceration	16 (5.6%)	21 (9.3%)	.104
Followed for other reasons	50 (17.2%)	7 (3.1%)	<.001

proportion of boys and expatriates, while hernia side distribution was similar. The predicted insurance coverage difference is also shown; however, there were limited (1%) out-of-pocket cases treated by a small private center affiliated with the public provider; 52.6% of the PV patients paid out-of-pocket, 82.5% of whom were boys.

Referral pattern

There was significant variation in referral patterns between the two providers (**Table 3**). The majority of the PV cases were self-referred to pediatric surgeons (72.8%), compared to only 17.2% for PB. Other physicians, mainly pediatricians and primary care physicians were the main sources of referral among PB cases (48%), of whom 17.2% were already followed-up for other illnesses. Meanwhile, the emergency department (ED) was a significantly more valuable access pathway for patients seeking care at PB as 35.2% of them presented and were referred from ED despite only 5.6% presenting with incarcerated hernias; however, there was no difference in the rate of incarceration between the two groups.

Access times

PV scores were widely better in all the major access to care indices (**Table 4**). The median time the patients waited to be evaluated by pediatric surgeons was 21 days for PV patients compared to 66 days for those accessing PB (*P*<.001). Similarly, wait time for surgery after diagnosis was much shorter for PV (4 days vs 31 days) than PB with narrower variability in the PV range (2-10 days) (*P*<.001). Overall, PV was able to cut the duration of the patient's symptoms to 33 days from 114 days reported by PB (*P*<.001).

DISCUSSION

In healthcare systems where publically subsidized healthcare is not well funded, PVs offer alternative access to care. Even in better funded social healthcare systems PVs offer a substantial proportion of services. For instance, in Britain, a country with an exceptionally high proportion of public spending, 13% of the healthcare spending in 2006 was in the private sector.[26] About 60% of what was spent on health in sub-Saharan Africa in 2005 was in the private sector,[27] and in India about 80% of care is provided by the private sector.[28] In South Asia, 80% of children in the lowest income quintile who have acute respiratory conditions are treated by PV.[29] In developing countries, the structure of care, including buildings, equipment, materials, supplies, and drug availability, tends to be superior among PVs.[30-33] Access

to care is generally better in terms of shorter waiting time and easier access,[7,34,35] resulting in greater patient satisfaction.[36] Despite that, it seems that many patients are still more confident in the public providers in these countries despite inferior access.[26,32,35,36]

In mixed healthcare systems, access to PV, whether for-profit or not-for-profit, is strongly related to adequacy of insurance coverage. Accumulated evidence highlights the impact of disparity of care and outcomes between the insured and uninsured patients, particularly in ischemic heart diseases[37,38] and cancers.[39] In fact, insurance-related limitation of access to care in these systems is associated with worse outcomes in hernia. In reviewing 147 665 hernia encounters, London et al concluded that hernia-related complications and mortality were significantly higher among the uninsured.[40] In a population-based US national study, Todd et al observed higher morbidity and mortality rates among children who were uninsured or publically insured compared to those who were privately insured.[41] Similarly, those uninsured children were more likely to present with perforated appendicitis.[42]

In our study, although we did not analyze the outcomes, we have demonstrated that access to pediatric surgical care can vary and is significantly better when offered by the private sector. Children who could access the PV were able to visit the appropriate surgical specialist three times earlier than those who accessed the PB. Many variables could have influenced the previsit access including the patient's level of education and the providers distance; however, once they visit the surgeon, after the diagnosis was made and the treatment planned, PV had better in-hospital efficiency by cutting surgery wait times by almost eight times compared to PB. Similar variation was noticed among the adult population.[7] Moreover, a Canadian group that compared almost exclusively publicly insured infant access to IH at their hospital with an American counterpart that serves mixed publicly and privately insured children, found that American infants had earlier repair and therefore were four times less likely to present with incarceration.[43]

As expected, faced with difficulty in access, PB patients tend to resort to the ED for non-emergent cases such as non-incarcerated hernias unlike those with access to PV who can arrange earlier surgeon visits directly or through referral from another physician. Similar phenomena has been reported by others.[43] This tendency is well described in the US healthcare system as privately insured patients who have better access to primary care are less likely to visit the ED compared to publicly insured adults[44,45] and children.[41,46] The resulting overcrowding of the ED by elective cases is believed to raise a barrier for more urgent cases and could threaten patient safety and pose a public health problem.[47] Unlike the PV elastic capacity that would expand based on affordable demand, governmental funding and internal services efficiency limit PB capacity to provide specialized services such as pediatric surgery. Consequently, to improve efficiency PB places primary care as a gatekeeper against self-referral to specialized services and in the meantime PV offers direct access through self-referral as a competitive advantage, which explains the high frequency of self-referrals. Similar phenomena could explain the higher percentage of children who are referred while being treated by other pediatric services for different illnesses at the PB. While access to PB is open to all cases, there is a tendency for academic centers to focus on treating more complex cases with a higher likelihood of better outcomes[48,49] while PV centers would more predictably focus on the more profitable ambulatory cases.[50] Both providers reported similar incarceration rates despite the large difference in wait times, which is inconsistent with what has been reported by others.[12,13] This can be explained by the coexistence of the two providers serving and even competing on the same population, which is quite unusual. Consequently, realizing the difficulty in accessing PB, patients with incarcerated IH tend to seek urgent care at the PV that offers them an earlier definitive management. This may explain the unexpectedly similar incarceration rates despite the significant variation in access.

As predicted, due to earlier access, PV patients were younger and more often male. We cannot accurately explain the higher proportion of boys; it could be attributed either to society's male preference or to their larger and worrying inguinoscrotal hernia appearance, which pushes the uninsured parents to seek

Table 4. Linear regression models comparing access time for public and private providers.

	Public (n=290) Median (interquartile)	Private (n=228) Median (interquartile)	Adjusted* *P* value
TTS (days)	66 (28-181)	21 (4-90)	<.001
SWT (days)	31 (9-77)	4 (2-10)	<.001
DOS (days)	114 (56-297)	33 (12-127)	<.001

*Adjusted *P* value estimated using linear regression models for log (days) which adjusted for age, sex, nationality, referred by, history of incarceration and followed for other reason. DOS: duration of symptom, the period from onset of symptoms to the date of surgery, TTS: time to surgeon, the period from the onset of hernia detection to the pediatric surgeon visit. SWT: surgery wait time, the period from the date of pediatric surgeon visit to the date of surgery.

care earlier at the PV despite the incurred expenses, as 82.5% of those who paid out-of-pocket at PV were boys. Another noticeable difference is the higher proportion of non-Saudi infants treated in the PV which has been attributed to the local workforce structure resulting in a higher proportion of privately insured non-Saudis in addition to the PB restricted eligibility to Saudi nationals.

Comparing outcomes was not the objective of this study, but we did not expect large variation due to the non-complex nature of the procedure. In addition, due to its sensitivity, PV are often resistant to voluntary outcomes reporting. Generally, the differences in outcomes between PV and PB are inconsistent and tend to vary across healthcare systems. A meta-analysis involving 38 million American patients showed higher risk-adjusted death rates among patients receiving care at private for-profit hospitals compared to not-for profit hospitals.[51] The same group performed another meta-analysis of over 500 000 hemodialysis patients, which similarly revealed a higher risk-adjusted mortality rate at for-profit facilities.[52] In a meta-analysis comparing outcomes in nursing homes, non-profts provided superior quality compared to for-profits in terms of fewer pressure ulcers, less use of restraints and better quality staffing.[53] On the other hand, in eastern Europe, privately run hemodialysis units reportedly have lower mortality rates compared to the public units.[54] In China, an analysis of 362 government and private hospitals found no differences in mortality when hospital characteristics and case-mix measures were controlled.[55] An Australian group reviewed 19 000 patients admitted with acute myocardial infarction and found lower mortality and unplanned re-admission of those treated by the PV compared to PB, including public academic hospitals.[56] Most studies favoring the outcomes of private not-for-profit providers originate from the US healthcare system where these providers are relatively well funded and better managed.

Due to the significant obstacles in accessing data at different provider sites in addition to limited resources, we could not perform an ideal population-based study; however, based on limited previous data this comparison could offer a valuable insight on the impact of privatization on the access to routine pediatric care.

In conclusion, access to pediatric surgical services can be significantly improved by healthcare privatization if it is matched by insurance coverage expansion. We do not recommend a particular type of provider, but in light of healthcare budget constraints, the co-existence of complementary private providers offers an additional valuable healthcare resource. The treatment outcomes should be closely monitored as access can be easily improved at the expense of quality. Both public and private sectors have different strengths and weaknesses, and a judicious blending of the two can produce an optimal system. Moreover, the coexistence of two systems can be a valuable tool for benchmarking to identify areas of potential improvements in each system.

Conflict of interest

The authors declare no conflict of interest.

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