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EC CARDIOLOGY
Research Article

Shelter Care before Cardiac Surgery- Is it Feasible for the Underprivileged?

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Received: May 01, 2019; **Published:** June 19, 2019

Abstract

Background: Reduction in postoperative morbidity and mortality among underprivileged cardiac afflicted patients is possible with meticulous preoperative preparation. This retrospective study deals with free cardiac surgery performed at Public Health Centre (PHC) by the surgical team of Hearts for Hearts (H4H), a Public Charitable Trust. It reveals that a cost effective, caring Shelter 'Udavum Karangal' (UK) that offers support for preoperative preparation before hospitalisation, is an important component of Cardiac surgical care for the underprivileged.

Materials and Methods: 81 predominantly paediatric (72.9%) with malnourishment (87%), anaemia70% and hypo proteinemia 60% were studied. < 1 - 18 yrs formed 72.9%, 18 - 60 yrs formed 24.6%. Slight predominance of females over males existed. Preoperative preparation was for 52/81 patients and 29/81 were postoperative patients needing further stay near PHC. Periodical follow up with accommodation at UK was possible. Congenital Acyanotics were 59.2%, Cyanotics and Ischaemic Heart Disease formed 11.1%. Rheumatic Valve Diseases were 29.6%.

Operated formed 69.2%. Patients treated early for later surgery were 25.9%. Maximum number of days in UK was 75 with a mean of 6.9 and a minimum of 1. 52/81 patients were treated as outpatients. (19/41) from UK. (22/41) was admitted to (PHC) to be treated as in-patients for preparation for surgery.

Chronic Respiratory infection and Chronic Congestive failure were (28/52) and (20/52) respectively. 2/52 had Secondary Pulmonary Hypertension [50-53]. 2/52 needed preparation for surgery later.

Result: Morbidity was graded by the number of days in ICU after surgery for Respiratory Infection, Chronic Congestive Failure and Secondary Pulmonary Hypertension. Not Morbid: Less than 7 days; Mild: 8 - 10 days; Moderate: 11 - 15 days and Severe: More than 15 days. Operative Mortality was mortality in the hospital or 30 days after

Respiratory infection after preoperative preparation became mild in 11/28, moderate in 9/28 and severe in 8/28 in spite of the preparation. There was no mortality in the severe group. It is noteworthy that there was only one death in a 4 month old child weighing 6kgms who developed septic shock after surgery. Among those with Chronic Congestive Failure due to Rheumatic valve disease 6/20 were mild, 7/20 moderate and 7/20 severe. 2/52 had Secondary Pulmonary Hypertension and 2/52 needed preparation for surgery later. These patients could be monitored and treated as outpatients in UK. This was possible due to coordinated interaction between the UK team and the Surgical Team of H4H at PHC.

For 63% of patients, the cost of stay inclusive of food in shelter was Rs 2400/- ($34.82) along with food. If the patient had to stay outside it would have been Rs 11,254 ($163.294). Cost of Stay in shelter (UK) is borne by Hearts for Hearts (H4H), a Public Charitable Trust and is free for the patient.

Conclusion: Health care supportive and cost effective UK is an important component in the management of underprivileged patients with heart diseases. Meticulous preoperative preparation and post-operative follow up contribute to reduction in postoperative morbidity mortality and quality of care later. Udavum Karangal (UK) A Non- Governmental Organization Chennai has offered such a Shelter for these patients undergoing cardiac surgery.

Keywords: *Cardiac Surgery; Malnourished; Anaemic; Under-Privileged; Pre-Operative Preparation; Shelter; Cost Effectiveness*

Abbreviations

PHC: Public Health Centre; H4H: Hearts for Hearts; UK: Udavum Karangal; LSEP: Lower Socioeconomic Status Patients; URI: Upper Respiratory Infections; ANOVA: Analysis of Variance

Introduction

Frequent respiratory infection and Congestive Failure are additional risk factors for malnourished [2,23-25], anaemic [26,28-31] and hypoproteinemic [32,33,35-37] cardiac afflicted patients from low socioeconomic strata [1]. They contribute to postoperative morbidity and mortality. Increased stay in hospital and cost hike [42,43,45,46] is also the direct result.

Preoperative preparation [48] to achieve baseline stability is important. Lower socioeconomic status patients (LSEP) cannot be treated adequately as outpatients from their far off homes. So, there is a necessity for a cost effective, patient-friendly shelter near the hospital.

Importance of risk factors, assessment and management

Risk factors in this population can be classified as related to psychosocial factors, severity of Chronic and Intermittent disease and co-morbid factors. Factors associated with their socio-economic status such as malnutrition, anaemia and hypoproteinaemia do not demand preoperative preparation. Procedures are tailored to achieve the basic norm during surgery. Severity of the disease such as frequent respiratory infection, Chronic Congestive Failure and Pulmonary Hypertension [49-51] need preparation to reach stability. Co morbid factors such as Caries teeth, Otitis Media, epileptic disorders and hepatic diseases need to be prepared adequately.

Majority of these conditions require Outpatient management. So, a shelter near the hospital will help in adequate stabilisation. Coordination between the Shelter team and Cardiac surgical Team in the hospital is mandatory. Monitoring drugs, clinical status and immediate admission should be possible. Above all it must be cost effective. A Shelter with the above characteristics will contribute to decrease in morbidity and mortality.

Hearts for Hearts (H4H) is a Public Charitable Trust whose surgical team perform free cardiac surgeries for the underprivileged at Public health Centre (PHC). Emphasis on preoperative preparation for cardiac surgery was laid by the surgical team of H4H Entire surgical management from detection to surgery and after is free for the patient. To reduce morbidity and mortality in this (LSEP) H4H is being supported by Udavum Karangal, a Nongovernmental organization for these underprivileged patients. Stay at UK is cost effective (Table 7-16) (Figure 3-6).

Staff of UK Interact to co-ordinate with H4H surgical team in the preoperative preparation of patients. They will be treated as outpatient to Public Health Centre (PHC) where surgeries will be performed later.

Materials and Methods

81 predominantly paediatric (72.9%) (Table 1) with malnourishment (87%), anaemia 70% and hypo proteinemia 60% were studied. < 1 - 18 yrs formed 72%, 18 - 60 yrs formed 28% (Table 2) (Figure 1). Slight predominance of females over males existed. Preoperative preparation was for 52/81 patients and 29/81 postoperative patients who needed periodical follow up. Congenital Acyanotics were 59.2%, Cyanotic and Ischemic Heart Disease 11.1. Rheumatic Valve Disease formed 29.6% (Table 3). 69.2% were operated and Non-operated for surgeries later were 25.9%.

	N	Mean	Median	Std. Dev.	Min	Max
Age	79	-	10	-	0	47
Weight	74	28.4	22.5	17.3	3.5	70
No. of days in hospital	55	12.87	12	5.3	4	32
No. of days	81	6.9	3	9.9	1	75
Cost	81	76008.62	78776	57084.26	315	176288
Sex	N	%				
Male	33	40.7				
Female	48	59.3				

Table 1: *Overall descriptive statistics.*

Age between 0 - 1 yr formed 4%, 5 - 10 yrs formed 27.2%, 10 - 18 yrs 21% and 1 - 5 yrs 19.8%. 19 - 60 formed 24.6% Females formed 59.3% and Males 40.7 % (Figure 2). Frequency of UK stay was VSD 40.7%, ASD 18.5%, Rheumatic Valve Disease 29.6% and the rest 11.1 % (including Ischaemic heart disease [54]). Frequency of those who underwent Surgery was VSD and Rheumatic valve Replacements 21%, ASD 17.3%. Those not operated 25.9% and others were 9.9% (Table 4).

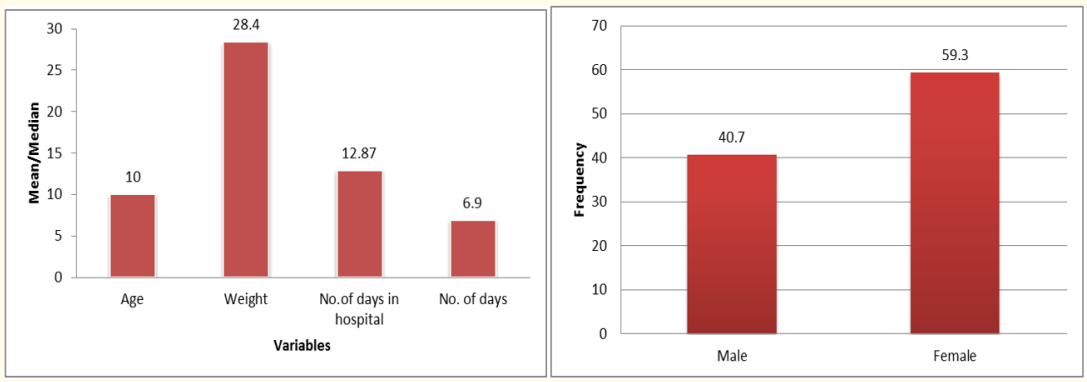

Figure 1: *Overall descriptive statistics.*

Age categories	Frequency	Percent
0 - 1 yrs	4	4.9
1 - 5 yrs	16	19.8
5 - 10 yrs	22	27.2
10 - 18 yrs	17	21.0
18 - 30 yrs	7	8.6
30 - 60 yrs	13	16.0
Total	79	97.5

Table 2: *Age categories descriptive.*

59 from the paediatric age group and 20 from the adult age group weighing between 3.5 to 70 kgs stayed from 1 - 75 days at Shelter - Udavum Karangal a well known destitute home with a special room with staff for this project.

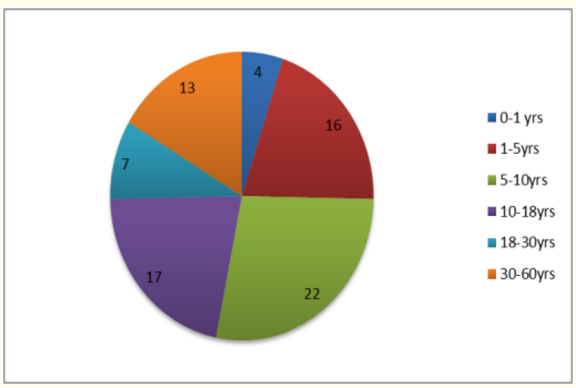

Figure 2: *Age categories.*

	Frequency	Percent
MR	13	16.0
ASD	15	18.5
VSD	33	40.7
RHD	11	13.6
others	9	11.1
Total	81	100.0

Table 3: *Diagnosis.*

57 had congenital heart diseases and 24 had valve and Ischaemic heart diseases [52].

	Frequency	Percent
Not yet operated	21	25.9
ASD	14	17.3
MVR	17	21.0
VSD	17	21.0
others	8	9.9
Total	81	100.0

Table 4: *Surgery.*

Among the 81, 39 surgeries were conducted on Congenital both simple and complex, 17 had their valves replaced. 21 were being prepared for surgery.

Maximum number of days in Shelter was 75 with a mean of 6.9 and a minimum of 1. 52/81patients were treated as outpatients. 19/41 were treated as outpatients in UK. 22/41 had to be admitted in hospital for treatment prior to surgery. Frequent Respiratory infection (28/52) (Table 4), Chronic Congestive failure (20/52) (Table 6). Secondary Pulmonary hypertension [49-51] (2/52) preparation for surgery later (2) was the reasons for stay at UK. Cost of Stay and food/patient and 2 attenders (for infants and Children) and one attender/adult patient is Rs 2400/- irrespective of the number of days.

Results

28/52 patients with Respiratory infection and 20/52 patients with Chronic Congestive Failure, 2/52 had Secondary Pulmonary Hypertension [49-51] and 2/52 needed preparation for surgery later. They could be monitored and treated as outpatients at UK. For 63% of patients, the cost of stay inclusive of food in shelter was Rs 2400/- ($34.83) irrespective of food. If the patient had to stay outside it would have been Rs 11,254. ($163.29) (Table 15). Cost of Stay in shelter is borne by Hearts for Hearts (H4H), a Public Charitable Trust and is free for the patient.

Infection Grade

- < 7 days no infection
- 7 - 10 Mild
- 10 - 15 moderate
- > 15 severe

S/No	PHC (Days)	UK (Days)	Post op infection	Grade
1	10	2	+	Mild
2	12	14	+	Mod
3	9	20	+	Mild
4	12	16	+	Mod
5	12	2	+	Mod
6	10	8	+	Mild
7	14	8	+	Mod
8	20	12	+	Severe
9	10	5	+	Mild
10	24	6	+	Severe
11	12	9	+	Mod
12	19	2	+	Severe
13	19	13	+	Severe
14	32	7	+	Severe
15	10	6	+	Mild
16	10	3	+	Mild
17	13	2	+	Mod
18	4	2	+	No infection
19	8	5	+	No infection
20	13	4	+	Mod
21	8	3	+	No infection
22	19	2	+	Severe
23	8	28	+	No infection
24	21	4	+	Severe
25	12	2	+	Mod
26	18	4	+	Severe
27	12	2	+	Mod
28	9	2	+	Mild

Table 5: *Congenital preop and post op infections.*

S/No	PHC (Days)	UK (Days)	Post op morbidity Grade
1	12	2	Mod
2	12	19	Mod
3	10	9	Mild
4	15	2	Mod
5	12	2	Mod
6	19	2	Severe
7	19	6	Severe
8	12	10	Mod.
9	21	13	Severe
10	10	8	Mild
11	19	4	Severe
12	17	4	Severe
13	18	27	Severe
14	9	8	Mild
15	17	1	Severe
16	12	4	Mild
17	8	2	Mild
18	12	2	Mod
19	12	4	Mod
20	8	5	Mild

Table 6: *Valve disease.*

Discussion

Preoperative preparation to reduce postoperative mortality and morbidity among the underprivileged is a compulsion [48]. Environmental factors operate in their homes and when they need tertiary care in a far off well equipped cardiac centre they cannot afford. So, there is a compulsion for a Shelter where they can be stabilised prior to surgery. This Shelter should allow them to be treated as outpatients till complete stabilisation or alternate as outpatients and inpatients before they are finally taken up for surgery. Shelter therefore becomes a treatment armamentarium. Their homeless state had to be corrected first. Thus shelter (UK) accommodated these patients. Udavum Karangal (UK), a Non- Governmental organization is such a centre.

Malnutrition [2,20-25], anaemia [26-31] and hypoproteinaemia [32-37] are independent risk factors for children undergoing cardiac surgery. Risk factors due to cardiac disease per se and co morbidities such as Respiratory infection [1-14] Chronic congestive failure [15-19] due to congenital and valve diseases [16,18,19] and Secondary Pulmonary Arterial Hypertension (PAH) add to postoperative morbidity and mortality. In adults Ischaemic heart diseases [52] pose additional Challenges.

Changes due to deficiencies of minerals and vitamins in haematology [4], caries teeth [10], Otitis Media [3], skin infections [4] play a large role in increasing post-operative morbidity. If they are adequately managed preoperatively as out-patients, reduction of post--operative morbidity occurs. In Ischaemic heart disease [52], preoperative management of Diabetes and Systemic Hypertension are the challenges.

This retrospective study shows that this is a wide spectrum of patients aged between 4 months to 70 years weighing between 3.5 to 70 kgs who stayed in UK from 1 to 75 days for preoperative preparation.

Surgeries included repair of Acyanotics, Cyanotics, replacement of valves and Coronary Artery Bypass Graft Surgeries and Complex Cardiac disease Surgeries. Irrespective of the type of cardiac disease common risk factors were malnutrition, anaemia and hypo-proteinemia. These risk factors were not attended to the preparatory phase of Surgical Management. All Infections at various sites including Upper respiratory infections (URI) were treated as outpatients. A common method of management involving accepted flowchart of drugs monitored by investigations was adopted. Investigations included Entire blood picture with particular focus on Total and Differential Leucocytes counts, Blood smear for toxic granules in neutrophils and CRP. Blood and urine culture for bacterial count and sensitivity were taken. Biochemical investigations for other organ monitoring were done

Flowchart was used by both the teams from UK and H4H. Interaction helped in the following.

Interaction

1. Recalcitrant infections were admitted to PHC.
2. Sudden exacerbations patients were immediately attended to and transported to PHC.
3. Elective surgeries were well planned with the stabilized patients.

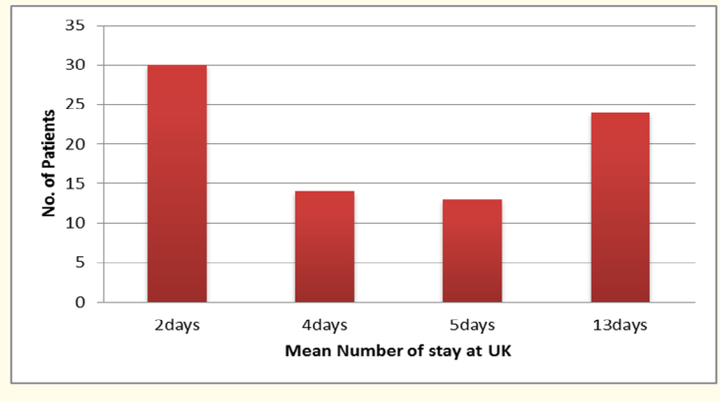

Figure 3: *Distribution of No. of days of stay at Udavum Karangal.*

District Vs Annual Income	N	Mean	Std. Deviation	Minimum	Maximum	ANOVA Test statistic, p-value
Others	15	64000.0000	20989.79344	36000.00	108000.00	1.362, 0.249
Chennai/Mamallapuram/ Vellore	6	60000.0000	31292.17154	36000.00	120000.00	
Salem/Dharmapuri	10	58200.0000	32747.51899	24000.00	120000.00	
Perambalur	20	69420.0000	15467.16726	48000.00	120000.00	
Thuthukudi	20	54300.0000	11594.46329	36000.00	72000.00	
Virudunagar	5	53280.0000	18071.85657	36000.00	72000.00	
Total	76	61089.4737	20641.09544	24000.00	120000.00	

Table 7: *District coded vs income.*

The ANOVA test to find if there is any mean difference in the annual income between the districts shows that the ANOVA test is not significant at 5% level of significance. In other words, there is no significant difference between the districts with respect to the mean annual income.

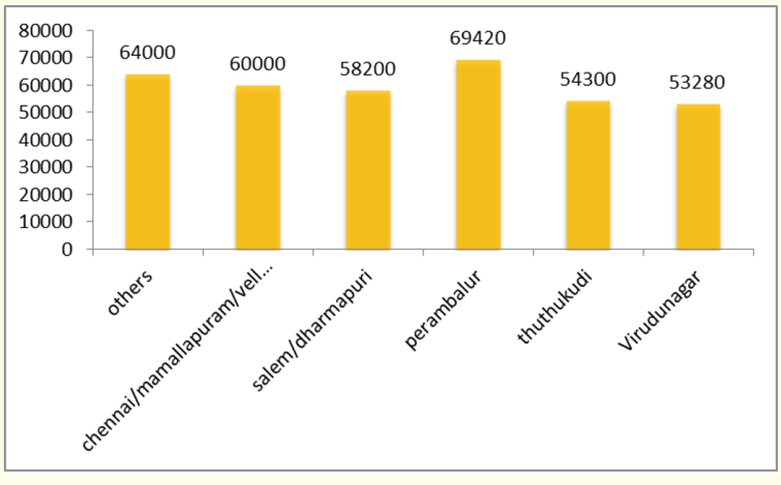

Figure 4: *Districts vs mean income.*

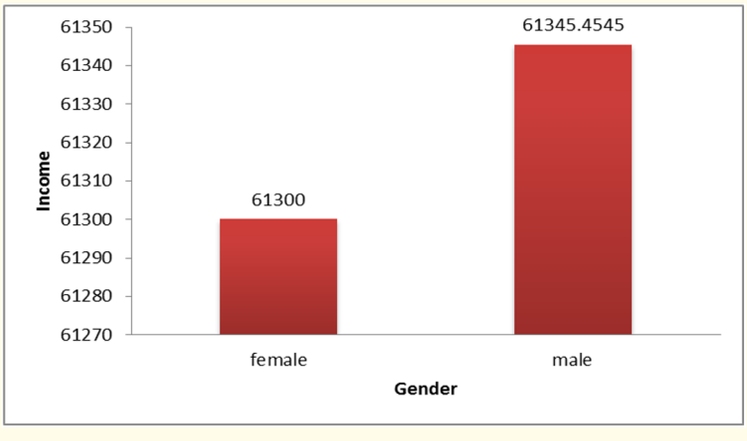

Figure 5: *Mean income between males and females.*

	Sex	N	Mean	Std. Deviation	Std. Error Mean	T test statistic, p-value
Annual income	Female	48	61300.0000	22283.97000	3216.41402	-0.010, 0.992
	Male	33	61345.4545	17165.02787	2988.04782	

Table 8: *Gender vs mean income.*

Although the mean income of males (M = 61345) is slightly higher than females (M = 61300), the t test shows that the mean income is not statistically significantly different between males and females.

		Others	Chennai/Mamallapuram/Vellore	Salem/Dharmapuri	Perambalur	Thuthukudi	Virudunagar
Sex	Female	7	3	6	12	13	5
	Male	8	3	4	8	7	0
Total		15	6	10	20	20	5

Table 9*: Gender vs districts.*

Comparing the distribution of Gender across different districts reveals that, maximum number of patients have come from Perambalur (N = 20, F = 12, M = 8) and Thoothukudi (N = 20, F = 13, N = 7) with majority of them are females.

	N	Minimum	Maximum	Mean	Std. Deviation
Compare_Cost	81	.46	34.38	3.2726	4.47586
Prop spent income	81	.02	.86	.1363	.15555
Prop spent income_UK	81	.02	.10	.0438	.01629
Coston inc	81	.00	4.86	1.4342	1.24658
Valid N (listwise)	81				

Table 10: *Relative comparisons.*

Explanation: Proportion of total cost outside on annual income

Taking the proportion of total cost while staying outside (inclusive of food and stay) to the annual income, we observed that on an average a person has to spend 13% of his annual income on food and stay if he has to stay outside.

Proportion of total cost in UK on annual income

Taking proportion of total cost while staying in Udavum Karangal to the annual income, we observed that on an average Udavum Karangal profits the patients from spending 13% of their annual income.

Also, another point to be noted is that the money spent by Udavum Karangal is on an average 4% of the patients income.

Comparing Cost spent outside and by Udavum Karangal

From the table it can be observed that the comparing the total expenses by staying outside is 3 times the average cost spent by Udavum Karangal on each patient.

Percentage of patients in each percentile of cost	25^{th}	5045.0000
	50^{th}	78776.0000
	75^{th}	116606.0000

Table 11: *Quartiles calculation for Cost of stay for patients.*

The above table shows that about 25% of the patients have to spend Rs. 5000/- as the cost of stay, about 50% of the patients have to spend Rs. 78,776/- as the cost of stay and 75% of the patients have to spend Rs. 1,16,606/- as the cost of stay.

Number of patients in each category of the spent cost categorized based on the percentile		
Cost	**Frequency**	**Percent**
Upto 25th percentile	21	25.9
25th - 50th percentile	20	24.7
50th - 75th percentile	21	25.9
Above 75th percentile	19	23.5
Total	81	100.0

Table 12: *Cost categorized based on percentile.*

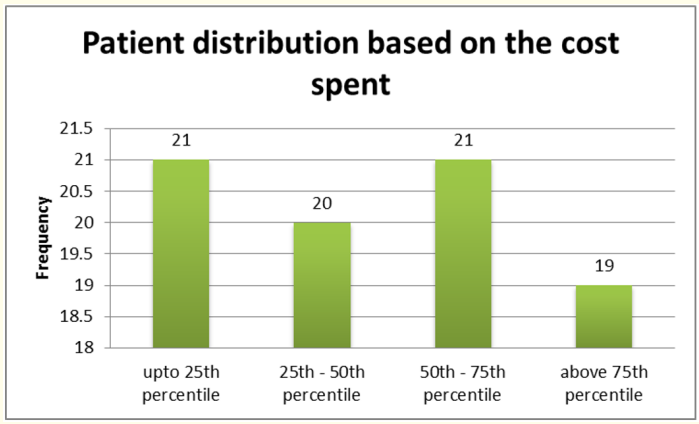

Figure 6: *Distribution of cost categorized based on quartiles.*

The above table shows that about 25% of the patients have to spend Rs. 5000/- as the cost of stay, about 50% of the patients have to spend Rs. 78,776/- as the cost of stay and 75% of the patients have to spend Rs. 1,16,606/- as the cost of stay.

		Total Cost Outside
Mean		7854.3210
Median		4400.0000
Std. Deviation		10742.05578
Minimum		1100.00
Maximum		82500.00
Percentiles	25	2200.0000
	50	4400.0000
	75	8800.0000

Table 13: *Total cost to be spent outside.*

The above table shows that about 25% of the patients have to spend a total cost of Rs 2200/- per day, about 50% of the patients have to spend Rs 4400/- per day and 75% of the patients have to spend Rs 8800/- per day.

	Frequency	Percentage
< 25th percentile	30	37.0
25th - 50th percentile	14	17.3
50th - 75th percentile	13	16.0
> 75th percentile	24	29.6
Total	81	100.0

Table 14: *Percentile of total cost per day.*

The above table shows the total cost to be spent outside is more than Rs. 2400/- for 51 patients i.e. greater than 70% of the patients.

Mean	11254.9020
Median	7700.0000
Std. Deviation	12357.65858
Minimum	3300.00
Maximum	82500.00

Table 15: *Total cost outside inclusive of food.*

For 51 patients (63%) of the patients, the cost of stay including food cost is above the standard cost of Rs. 2400 spent to Udavum Karangal for a patient stay (inclusive of food). For the 51 patients the average expenditure inclusive of food is Rs. 11254.

No. of days in Udavum Karangal	< 25th percentile	N	Valid	30
			Missing	0
		Mean		1.8667
		Median		2.0000
		Mode		2.00
		Minimum		1.00
		Maximum		2.00
	25th - 50th percentile	N	Valid	14
			Missing	0
		Mean		3.5000
		Median		4.0000
		Mode		4.00
		Minimum		2.00
		Maximum		4.00
	50th - 75th percentile	N	Valid	13
			Missing	0
		Mean		4.6154
		Median		5.0000
		Mode		2.00[a]
		Minimum		2.00
		Maximum		7.00
	> 75th percentile	N	Valid	24
			Missing	0
		Mean		16.3333
		Median		12.5000
		Mode		8.00
		Minimum		2.00
		Maximum		75.00

Table 16: *Break up of number of days of stay in Udavum Karangal and the actual expenditure (categorized) had the patients not been in Udavum Karangal.*

The above table shows, 14 patients have stayed on an average for 4 days in Udavum Karangal. The average cost should have been Rs. 4400 but the cost spent is only Rs. 2400.

On an average 13 patients have stayed for 5 days each on an average and the cost of their stay should have been between Rs. 4400 - Rs. 8800/person but the actual expenditure on an average is Rs. 2400 per person.

Similarly, 24 patients have stayed for 13 days on an average and the cost of their stay should have been above Rs. 8800/person on an average but the actual expenditure on an average is Rs. 2400/person.

Among the risk factors that had to be challenged during preparation for surgery, Respiratory infection, Chronic Congestive failure and PAH demanded meticulous care for stabilisation. This involved stay in Shelter UK and treated as out patients in hospital, admission if needed and return to shelter for ensuring stabilisation after surgery. Otitis media [10], Caries teeth [20] skin infections [6] were treated as out-patients. Till monitoring factors of Total Leucocytes count, Differential Count, ESR, Blood smear for toxic granules, CRP, Culture sensitivity of sputum, urine and blood (if positive) treatment with relevant antibiotics, Bronchodilators and humidifiers were continued.

Respiratory infections were classified as mild, moderate and severe as per their stay in the hospital prior to surgery [40] needed preoperative admissions.

Respiratory infections were associated with Congestive Failure in congenital. In valves congestive failure were treated with anti-failure drugs, diuretics and peripheral vasodilators with anti-arrhythmic agents for associated atrial fibrillation.

During this period in UK following interaction and coordination between the staff in UK and H4H staff smoothened the quality of care

- Both the organizations' staff exchanged orally and document twice instructions regarding management.
- If there were any need to hospitalise the patient in PHC, sufficient time was given for shifting the patient. The whole process of Transportation was monitored by both the staff.
- If the family of patients had any problems, they were shared to solve and render proper care.
- In case stabilisation took more time the daily wage earner was able to return to his remaining family and return on the day of surgery.
- UK was cost effective for H4H so that free surgery and associated expenses were taken up by H4h.
- One more week at Shelter after discharge from PHC ensured that the patients were completely stable.
- Periodical follow up was also possible to assess cardiac morphology and function.
- Non-operated patients were those who needed surgery at a later date. These patients were also followed.

Conclusion

Cardiac surgery in the malnourished, anaemic and hypoproteinaemia lower socioeconomic population can undergo surgery with acceptable mortality and morbidity. Preoperative preparation for risk factors such as frequent Respiratory infections, chronic congestive failure and Secondary pulmonary hypertension that need intensive care can be treated in Shelter and hospital for better results. Partnership association between NGO such as Udavum Karangal, Public Charitable Trust, H4H and Hospital like PHC ensure that.

Secondary Pulmonary Hypertension; 3 patients were treated with Pulmonary Vasodilators for 4 - 6 months before being taken up for Double Flap PTFE Patch Closure of VSD. They were also prepared for 2 days in UK before surgery

The most important factor is the cost-effectiveness in UK. Patients received the best quality care for a nominal amount which allowed H4H to direct financial support from donors for other expenses.

Acknowledgement

We acknowledge the Noble service of Mr. Vidhyakar, the Founder of Udavum Karangal (UK), - Helping Hands, a Non-Governmental Organisation at Chennai.

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