Cost of care for preterm babies in Jinja Regional Referral Hospital, East-central Uganda: A provider perspective

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ABSTRACT

Introduction: Preterm birth and its complications are a major global health burden and significantly contribute to the under-five mortality in Uganda. This study aimed at identifying the morbidities suffered by preterm babies and the cost of preterm care to the provider in Jinja Referral Hospital. **Methods:** This was a one-year cost analysis of preterm care from August 2015 – July 2016. The study took on a micro-costing approach, through which medical and accounting records, were reviewed for 507 preterm babies that were seen over the year to determine morbidities of preterm infants and costs from the provider perspective. Analysis of findings was done using a Microsoft excel sheet. Costs were converted to US$ for the annual exchange average rate of 2016. One-way sensitivity analysis was done to establish the impact of cost drivers on the total cost. **Results:** We found that the most prevalent morbidities among preterm babies were; neonatal hyperbilirubinemia, respiratory distress and neonatal septicaemia. The total annual cost of preterm care from the provider perspective was US$ 54,108 and the unit cost of care per preterm baby was US$ 107 at Jinja Regional Referral Hospital. Cost drivers included; equipment, personnel and utility costs (water and electricity). **Conclusion:** The cost of preterm care is high and sub-optimal from a provider perspective. It is characterized by stockouts of drugs and supplies which are critical in the care that is required to boost the survival of preterm babies. Improving funding for preterm care may be helpful in enhancing preterm survival.

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Introduction

Globally, over 15 million babies are born alive annually before 37 weeks of pregnancy are completed [1,2]. More than 60% of preterm births occur in Africa and South Asia [3,4]. In Uganda, 14% of the babies are born preterm every year [5].

Preterm birth accounts for 28% of neonatal deaths worldwide [6]. The mortality burden is approximately 6 times higher in low income countries compared to high income countries [7]. Studies have found preterm mortality to majorly arise from prematurity, respiratory difficulties, convulsions, congenital anomalies and infections [8-10]. Prematurity is the main cause of death accounting for 38% of deaths among neonates in Uganda [11]. Out of the babies that were born in Jinja Hospital in December 2015, approximately 47% were preterm and 31% died within a month (Anecdotal data).

Immediate complications of preterm births are; asphyxia and infections [12,13], while long term complications include; neurodevelopment disabilities such as mental sub normality, cerebral palsy, visual and hearing ailments, cognitive and language delays, learning disabilities, emotional and behavioral problems [14]. Immediate complications of preterm births are; asphyxia and infections [12,13], while long term complications include; neurodevelopment disabilities such as mental sub normality, cerebral palsy, visual and hearing ailments, cognitive and language delays, learning disabilities, emotional and behavioral problems [14].

Caring for preterm babies in developing countries is constrained by availability of health care resources which threaten the survival of the babies [15]. This has vast physical, psychological and economic costs to the health system and families [14,16]. These stem from instant neonatal intensive care and lost economic productivity of those involved in the care [17]. The health system incurs direct medical, non-medical direct costs, and overhead costs in the care of preterm babies [18]. Personnel and equipment have been reported as the main cost drivers [19-21]. In Brazil, the cost of professional services was estimated to be U$ 70,000 [20]. Narang from India, found the cost of equipment to be two thirds of the total establishment of a preterm care unit which was valued at U$ 860,000 [21] . However, in Nigeria, the general hospital cost of care for a preterm baby ranged from U$211.1 to U$ 1573.9 [22]. The high costs of care have been attributed to the length of stay [23], gestational age and birth weight of the babies where costs were seen to increase with a decrease in gestational age and birth weight of the babies [19,22,24].

A number of interventions are known to improve on preterm survival. For instance, antenatal corticosteroids are administered to strengthen the premature babies´ lungs. The other interventions include neonatal resuscitation, improved cord care, breastfeeding support, effective treatment of neonatal infections and Kangaroo Mother Care (KMC) which provides warmth to the baby and controls the heart and breathing rates [17].

While cost estimates provide information that can guide development of public health policies, and setting resource allocation priorities, there is minimal evidence on the cost of preterm birth care in Uganda. However, given the mortality and financial burden associated with preterm births, it is critical to do a cost analysis of the care for preterm babies. This study estimated the cost of care for preterm babies in East central Uganda from a provider perspective.

Methods

Study design and setting

We conducted a cost analysis of the care for preterm babies in Jinja district, in East Central Uganda, during a one-year period from August 2015 through July 2016. The district has 117 health facilities; 49 government owned, 18 private not for profit, and 50 registered private for profit. There are 14 registered private health facilities that offer delivery services in the district. This study was carried out in Jinja Regional Referral Hospital (JRRH) in the industrial town of Jinja which serves as a primary contact hospital and regional referral hospital for eleven districts i.e., (Bugiri, Iganga, Jinja, Kaliro, Kamuli, Kayunga, Mayuge, Luuka, Namayingo, Namutumba, and Buyende) with an overall catchment population of 3.5 million people. The hospital offers general health care and is also an internship hospital, where graduates of Ugandan medical schools can undergo internship under the supervision of consultants and specialists in the designated medical and surgical disciplines. There is

also training and research for different medical cadres and the hospital is annexed to Jinja Nalufenya Children´s Hospital. The hospital reports a monthly average of 556 deliveries and 60 preterm births. The hospital was purposively selected because it has adequate numbers of clients and a preterm care unit.

Cost analysis definition

We defined cost analysis as the act of breaking down a cost summary into its ingredients and reporting on each factor for the given period. The cost analysis took on a micro-costing approach through which costs were estimated from the provider perspective[19]. Costing involved; identification of resources, measuring them, valuing them, totaling up the costs and calculating the unit costs. Cost data of resource items used by the facility in providing preterm care were collected through observation using an observational checklist. This was used to collect data on capital resources like equipment types, wattage, and furniture. It was also used to collect information on recurrent resources like personnel type and number of cadres. A time sheet was used to estimate the time spent by different cadres in preterm care.

Record review was used to obtain retrospective data on preterm babies that were seen during the costing period. It was also used to capture cost data on salaries, drugs, consumables and utilities. This data was collected for a period of 1 year (August 2015 - July 2016). We excluded incomplete records. The costs were categorized as capital and recurrent costs.

Inputs

Costs reflected resources used to deliver care to preterm babies. Financial costs included capital costs such as equipment, furniture and recurrent costs like salaries, utilities, stationery, drugs and supplies [25]. Capital costs were annualized and discounted at 3% per year [26] with useful year approximations obtained from WHO CHOICE table. Furniture was assumed to have 8 useful years, while medical equipment were assumed to have a useful life of 5 years [1]. The standard formula that was used for annualization is;

$$E = \frac{K}{(1-(1+r)^{-n}/r}$$

[2], Where; (E), the equivalent annual cost = capital (K) divided by the annuity factor;

$$(1-(1+r)^{-n}/r$$

E = equivalent annual cost; K = capital (purchase price); r = discount rate; n = number of years over which the capital item depreciates (expected useful years of the capital item).

Capital costs for preterm care were allocated based on the amount of time they were used by the preterm babies. Those that were shared among preterm and full-term babies, the proportion of preterm babies out of the total number of babies was used to allocate the costs for preterm care. Capital items, such as buildings were not considered because in most cases new buildings may not be set up. In addition, shared costs like administration, and maintenance costs were not included as they were assumed not to substantially affect the cost of preterm care.

Utility costs were determined according to consumption in the special care unit. Costing of water was done based on litres of consumption in the special care unit and charged as per unit cost of water for institutions [27]. The cost of electricity cost was estimated based on wattage for different equipment, bulbs and tubes, run time per day and charge per kilo watt [28]. Personnel salaries were determined based on hours worked and salary scales. The average dollar rate was used for the year of data collection. Costs were then converted to USD (using the conversion annual average rate of USD1.00=UGX, 3442.96, the official exchange rate from August 2015 to July 2016 [29].

Data sources, measurement and quality control

Data were collected on preterm babies that were seen during the one-year costing period. Data sources included procurement records, accounting records, pharmacy records, laboratory records, and expert opinion. Socio-demographic data, length of stay, and morbidities were obtained from medical records review aided by a data abstraction form.

Data on capital resources - (i.e., equipment and furniture) were obtained using observation aided by a checklist and expert opinion.

Data on recurrent resources - (i.e., personnel, drugs, supplies, investigations and utilities) were obtained through record review and expert opinion.

The research team made daily visits to the hospital, and systematically reviewed records that met the inclusion criteria. The interviews were conducted by trained research assistants with a medical background and fluent in the local languages spoken in the study area.

Data analysis

Descriptive analysis was used to explore, describe and summarize socio-demographic characteristics of preterm babies, average length of stay, morbidities that preterm babies suffered, costs by weight and disease conditions the infants suffered. The statistical outputs were summarized in descriptive tables as frequencies, percentages or proportions. Cost estimates were entered into Microsoft excel 2007, and analysis was done to get the total and average costs of preterm care to the provider.

Sensitivity analysis

To ensure robust findings, one-way sensitivity analysis was done to assess the impact of variations in cost items on the total cost. Sensitivity analysis involved altering various inputs within calculated input ranges and noting the effect on total cost. Variables that were used for sensitivity analysis from the provider perspective were; personnel cost, drugs, supplies, and equipment.

The upper limit for sensitivity analysis was got by multiplying by two and the lower limit by dividing by two [30]. A positive sensitivity estimate meant the total cost was sensitive to the input cost of interest. The higher the positive value, the more sensitive the total cost was to that input and vice-versa. A negative sensitivity implied that the total cost decreased with an increase in that particular input. The input figure in the total cost (output), can be used to estimate the input with as much accuracy as possible. In the first round, we did general sensitivity analysis on particular capital and recurrent input costs and observed their impact on the total cost.

In the second round, we used discount rate for sensitivity analysis in which we assumed a range of discount rates on equipment costs and observed the impact on the total cost. In this case, equipment cost was altered using a range of discount rates, that is 5%, 10% and 15% and we observed the impact on the total cost. In round three, sensitivity analysis was done using length of stay. First, we assumed length of stay less than the average length of stay of 7.5 days in which a factor of three was used for different cost inputs. Then we later used a length of stay of 15 days which was above the average length of stay of 7.5 days and observed the impact on the total cost.

Sensitivity analysis

Assumptions

It was assumed that by the time preterm babies weigh 2.5 kgs, all major costs for preterm care would have been incurred.

It was also assumed that the babies of a specified weight category for example; <1000g, 1000-1499g, 1500-1999g, and 2000-2499g received the same care.

It was assumed that parameter values from the provider perspective remained constant throughout the period of preterm care.

In conducting sensitivity analysis using length of stay, we assumed days less than the average of 7.5 days for all babies less than 2000g that is 3 days and also days more than the average length of stay that was 15 days.

We assumed discount rates of 5%, 10% and 15% for capital inputs (equipment) in conducting sensitivity analysis using discount rate.

Ethical approval

We sought ethical approval from Makerere University School of Public Health Higher Degrees Research and Ethics committee. We received permission to conduct the study from the management of Jinja Regional Referral Hospital where the research was conducted. Interviews were conducted and records reviewed after written informed consent was obtained from the study participants and permission from relevant authorities within the hospital.

Results

A total of 1,519 live births were seen in Jinja Hospital over the one-year costing period, of which 507 (33.4 %) were preterm babies. A higher proportion of the babies that were seen were females 259 (51.1%) compared to males 248 (49.9%). The average length of stay for the babies that weighed less than 2000g was 7.5 (4.8-10.2) days, while that of babies that weighed between 2000g and 2499g was 5.6 (4.3-6.9) days. Most of the preterm babies that were seen weighed between 1500g - 1999g, 199/507(39.25%), those that weighed 1000g - 1499g were 134/507 (26.43%), those that weighed 2000g - 2499g were 134/507 (26.43%), while those that weighed 0-999g were only 40/507 (7.90%).

Morbidities of preterm babies during the period of August 2015 - July 2016

The most prevalent morbidities among preterm babies during the study period included neonatal hyperbilirubinemia, respiratory distress and neonatal septicaemia **Figure 1**.

Costs of preterm care to the provider

The total annual cost of preterm care to the facility was US$ 54,108.07 and the annual cost of preterm care per preterm baby was US$ 106.72. The total capital costs were US$ 6,114.42 and recurrent costs were US$ 47,993.65 **Table 1**

Equipment formed the biggest proportion of capital costs US$ 6,084.4 (99.5%) **Table 2**. Personnel costs formed the largest proportion of the recurrent costs, that is, US$ 32,300.4 (67.3%). This formed a substantial amount of expenditure from the provider perspective **Table 3**.

Utilities (i.e., electricity and water) cost US$ 11,028.66 (23%), that is US$10,864.81 and US$ 163.85 respectively. Investigations accounted for the lowest proportion of recurrent costs of US$ 5.78 (0.0 1%).

Costs by weight and disease conditions (morbidities) preterm infants suffered during the period of August 2015 to July 2016

Majorly, costs were incurred among babies that weighed 1500g -1999g and the most prevalent condition in this category was neonatal jaundice. However, neonatal jaundice occurred amongst all categories of weight.

Respiratory distress affected all babies across weight categories but especially the 1000g -1499 and it is within this category that most of the costs were incurred in management of this condition.

Neonatal septicaemia was prevalent among babies 1000g and above, but the magnitude was higher for bigger babies that weighed 2000g and above. This is also the category most of the costs were incurred for this condition.

Underweight mostly affected babies 0 - 999g which is also the category were most costs were incurred as a result of underweight, and attributed longer periods of stay in hospital **Figure 1**.

Sensitivity analysis

The total cost was sensitive to personnel costs, utilities, drugs, supplies and equipment costs. Multiplication of equipment costs by two (upper limit), had a 22% increment on the total cost, while division by two (lower limit), had a - 4% reduction on the total cost.

When the personnel cost was multiplied by two (upper limit), a 118% increment was realized on the total cost, while the division of personnel cost by two (lower limit), had a -31% reduction on the total cost. When the cost for utilities was doubled (upper limit), a 20% increment on the total cost was realized, but when the cost for utilities was halved (lower limit), a -10% reduction on the total cost was realized. When the drug costs were doubled (upper limit) the total cost increased by 6%, and division of the drug costs by two (lower limit) reduced the total cost by -3%.

Sensitivity analysis therefore showed that the total cost of preterm care to the provider was mainly sensitive to personnel costs, equipment and utilities **Table 4**.

In the second round, when we used discount rate for sensitivity analysis and altered equipment cost using a range of discount rates, that is 5%, 10% and 15%, the total cost was most sensitive at a discount rate of 10% giving 0.11% change in the upper limit and 1124.5% change in the lower limit of the total cost.

At a discount rate of 5%, there was a 0.6% change in the upper limit and 224.9% change on the total cost. However, when a discount rate of 15% was used, 0.11% change was realized for the upper limit of total cost and 0.75% change in the lower limit of the total cost implying less sensitivity at 15% discount rate **Table 5**. When sensitivity analysis was done using length of stay of 3 days and 15 days, the total cost was found to be more sensitive to personnel costs at 3 days giving an upper limit of 179% change in the upper limit and a 16.6% change on the lower limit of the total cost and least sensitive to drug costs at 2.07% change in the upper and lower limits.

At 15 days of stay in hospital, the total cost was found to be more sensitive to utility costs at 30574% change in the upper limit and 1.4% change in the lower limit and least sensitive to drug costs giving a 0% change in the upper limit and 0.4% change in the lower limit **Table 6**.

Discussion

We identified the common morbidities suffered by preterm babies and conducted a cost analysis of the care for preterm babies from the provider perspective. The common conditions that preterm infants suffered during this study were respiratory distress and neonatal hyperbilirubinemia. Other complications that were found by this study were septicaemia and asphyxia. These conditions lead to longer period of stay in the hospital and more resource consumption as has been reported by other studies [30,31].

The total annual cost of preterm care to the provider was US$ 54,108.07. The annual cost of preterm care per preterm baby to the provider was US$ 106.72. The low cost could be attributed to stock outs of drugs and supplies implying the cost should have been much higher had all preterm care inputs been available at the time of need. The treatment protocol in this setting could also be using low cost drugs and supplies due to affordability issues, which could emanate from budget constraints, but may also suggest costs are channelled to the mothers or care takers of the infants. Other studies that were done in Kenya and Eastern Uganda also reported stock outs of drugs and supplies required for patient management [32-34].

Although not many cost analyses on preterm care have been done in this region, studies that were done in low-middle income settings, found the cost of care for preterm babies much higher than that reported by this study [20,22,35,36]. Differences may be due to variations in treatment protocols regarding care for preterm babies, but also in Uganda, the drugs recommended in the protocol are often unavailable. In addition, the Doctor - patient ratio in Uganda is 1:12,000, with 25% of doctors as foreigners whose stay can´t be trusted [37]. This implies the number of preterm babies per specialist is even higher in Uganda compared to other countries. One paediatrician or neonatologist attends to thousands of infants and children [38]. Studies in high income settings have reported very significant average costs of preterm care [39,40]. This is possibly due to more sophisticated management of these infants.

We found expenditure on personnel as a key cost driver (US$ 32,0.4), followed by utility costs (US$11,028.66). Other studies reported a substantial expenditure on health personnel as a significant cost driver associated with preterm birth, for example Geitona et al reported US$ 438,477 [30], Zainal et al stated personnel costs as three quarters of the total overhead costs [35], Comert et al found, US$ 85,182 [36], and Desgualdo et al quantified personnel costs as US$ 70,000 [20]. The variation in expenditure on personnel could be attributed to more specialists in preterm care in other settings, higher staffing levels as opposed to suboptimal staffing levels, in this setting coupled with few numbers of specialists and dual practice. This implies less time spent in preterm care, as well as low pay for medical personnel in the Uganda public health system. The considerable expenditure on utilities particularly electricity is due to the fact that most of the preterm neonates are managed intensively using life support machines which run most of the time-consuming power.

In 2005, Narang et al.; conducted a study in India, and reported the main cost driver in the preterm care unit to be equipment, which was estimated to be two thirds of the total establishment cost for a preterm care unit [21]. This may be a result of better technological advances in India.

We found that the majority of infants weighed between 1500g - 1999g. Costs were seen to decrease with an increase in birth weight as reported in Brazil [5, 6]. The most prevalent condition was neonatal

jaundice which affected the majority of infants that weighed 1500g - 1999g and was associated with the highest amount of costs. Other studies have reported respiratory distress as the most prevalent and has been associated with high costs as was found by our study [7, 8]. In this study, respiratory distress affected all categories of infants across weights but was prevalent among babies that weighed 1000g - 1499g.

Babies that weighed less than 2000g had a longer average length of stay of 7.5 days. Similar findings were found in Brazil in which babies smaller babies stayed longer in hospital [9].

This study did not include other shared costs such as administrative, communication and maintenance costs. However, these contribute minimally to the preterm care cost.

Our study had some limitations. For instance, the study was conducted at a public health facility which may not be representative of all the preterm care settings in the region. This may affect external validity. In addition, preterm deaths were excluded suggesting no costs were captured for this category. Also, infants that developed complications following the initial discharge were readmitted in the children´s hospital, so we could have missed out on the readmission costs.

Sensitivity analysis was done using conservative estimates for the upper and lower limits. We used Length of stay and discount rates for sensitivity analysis. In using length of stay, the total cost was more sensitive to length of stay of 15 days which was above the average of 7.5 days, however, it was sensitive at 3 days which was below the average length of stay. A similar trend was observed for alterations in personnel costs.

When discount rate was used for sensitivity analysis, the total cost was most sensitive at 10% discount rate, remained sensitive at 5% discount rate but, became less sensitive at 15% discount rate.

Most of the time one parameter may not co-simultaneously increase or reduce within the same magnitude. However, this helped in knowing the importance of different cost inputs on the total cost (output), which is crucial for accurate estimation of the inputs.

We recommend more costing studies on preterm care with an ideal standard of care incorporated, and long-term economic impact of preterm birth.

Conclusion

The cost of care for preterm babies was very low as a result of stockouts of drugs and supplies required for the care. This suggests the costs may be pushed to the mothers/caretakers. The government should improve funding for public health facilities particularly regional referral hospitals that serve a multitude of districts to be able to procure drugs, supplies and equipment that is necessary for preterm care.

What is known about this topic

- It is already known that in Uganda, 14% of the babies are born preterm every year
- Preterm birth is the main cause of death among neonates, accounting for 38% of the deaths
- Preterm babies are prone to complications that are immediate after birth or later in life
- It is also known that inadequate health care resources are a major threat to survival of preterm babies
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What this study adds

- The study will provide information on cost estimates that can guide development of public health policies, and setting resource allocation priorities on preterm birth care in Uganda

Competing interests

The authors declare no competing interests.

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Authors' contributions

ZB: Wrote the study protocol, supervised the data collection, conducted data analysis, wrote the initial draft of the manuscript and reviewed the final version of this manuscript. EKE: Reviewed the study protocol and all the drafts of the manuscript. GGO: Participated in analyzing the data. ANK: Supported review of the drafts of the manuscript. FS: Reviewed the study protocol and all the drafts of the manuscript.

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Tables and figures

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Table 1: Summary of preterm care expenditure in JRRH - August 2015/July 2016 to the Provider		
CAPITAL COSTS	**AMOUNT (US$)**	**PERCENTAGE***
Equipment	6,084.4	99.5%
Furniture	30.02	0.49%
Subtotal	**6,114.42**	**100%**
RECURRENT COSTS		
Drugs	3,367.53	7.02%
Supplies	1278.70	2.7%
Investigations	5.78	0.01%
Personnel	32,300.4	67.3%
Utilities	11,028.66	23%
Stationery	12.58	0.03%
Subtotal	**47,993.65**	**100%**
Total annual cost (US$)	**54,108.07**	
Total number of preterm babies seen in the year	**507**	
Average annual cost per preterm baby (US$)	**106.72**	

Table 2: Costs on preterm care equipment for JRRH June 2015/July 2016 to the provider

Item	Volume used	Annualized unit cost (US$)	Total annual cost (US$)	Percentage allocation to preterm babies	Amount (US$) attributed to preterm babies	Source
Oxygen concentrators	3	190.26	570.79	33.38%	190.53	Crown Health Care (CHC)
Incubators	8	311.63	2493	100.00%	2493	CHC
Infant warmers IR 200	3	539.08	1617.23	100.00%	1617.23	CHC
Pulse oximeter	4	76.11	304.42	33.38%	101.62	CHC
Instrument trolley	2	40.67	81.34	33.38%	27.15	JMS
Stethoscope	3	6.80	20.40	33.38%	6.81	JMS
Metallic tray	2	31.71	63.42	33.38%	63.42	JMS
Enamel tray	1	6.34	6.34	33.38%	2.12	JMS
Plastic bowls	4	0.32	1.27	33.38%	0.42	JMS
Weighing scale	3	28.54	85.62	33.38%	28.58	CHC
Baby cots	9	24.10	216.90	33.38%	72.40	CHC
small cushions	27	3.81	102.74	33.38%	34.29	CHC
Small drums	3	65.66	196.97	33.38%	65.75	JMS
Ambubag	2	17.13	34.25	33.38%	11.43	CHC
Photo therapy machine	3	101.47	304.42	33.38%	101.62	CHC
CPAP machine	1	190.26	190.26	90.00%	171.23	CHC
Foot sucker	2	90.19	180.38	33.38%	60.21	JMS
KCM beds	4	152.21	608.84	100.00%	608.84	CHC
KCM mattresses	4	5.81	23.23	100.00%	23.23	JMS
Metallic stand	1	2.59	2.59	38.38%	0.86	CHC
Alcohol dispensers	2	10.78	21.56	33.38%	7.20	CHC
Dust bins	4	14.77	59.07	33.38%	19.72	JMS
Inverter	1	412.23	412.23	33.38%	137.6	Market price
Batteries for inverters	6	101.47	608.84	33.38%	203.23	Market price
Fitting inverter	1	31.71	31.71	33.38%	10.58	Market price
Thermometer	2	0.64	1.27	33.38%	0.42	JMS
Kettle	1	2.54	2.54	33.38%	0.85	Market price
Peng sucker	10	0.95	9.51	33.38%	3.17	CHC
bulb sucker	5	0.95	4.76	33.38%	1.59	CHC
Cheatle forceps container	1	4.49	4.49	33.38%	1.50	JMS
Cheatle forceps	1	2.57	2.57	33.38%	0.86	JMS
Computer	1	50.74	50.74	33.38%	16.94	Market price
Total cost - Equipment (US$)			**8313.7**		**6084.4**	
Total cost - Furniture (US$)			**83**	33.38%	**30.02**	Market price
Total capital costs (US$)					**6,114.42**	

Table 3: Expenditure on personnel in preterm care in JRRH August 2015/July 2016; Provider perspective

Cadre	**Number of units**	**Hours/week (A)**	**Full Time Equivalent (FTE)/Month (days) (B)**	**Gross salary/month/ cadre (US$) (C)**	**FTE Monthly salary (US$)**	**Total expenditure on personnel per year (US$)**
Consultant paediatrician	1	24	12	844	337.60	4,051.20
Medical officer special grade	1	16	8	651	173.60	2,083.20
Intern Doctors	2	40	30	220	220	5,280
Nursing Officer	1	40	30	265	265	3,180
Registered midwives (paid as enrolled)	2	40	30	181	181	4,344
Registered nurse	1	40	30	181	181	2,172
Senior nursing officer	1	40	30	389	389	4,674
Enrolled mid wives	3	40	30	181	181	6,516
Total (US$)						32,300.40

Table 4: Sensitivity analysis of key cost inputs to the provider					
Element	**Factor**	**Amount**	**Change in total**	**%change**	**Comment**
Equipment	×2	6,084.4	66,394.45	22%	More sensitive
	÷2		51,183.45	-4%	
Personnel	×2	32,300.4	118,362.91	118%	More sensitive
	÷2		37,611.91	-31%	
Utilities	×2	11,028.66	65,254.31	20%	
	÷2		48,711.32	-10%	More sensitive
Drugs	×2	3,367.53	57,593.18	6%	
	÷2		52,541.88	-3%	Sensitive
Supplies	×2	1278.70	55,504.35	2%	Less sensitive
	÷2		53,586.30	-1%	

Table 5: Sensitivity analysis using Discount rates of 5%, 10% and 15%					
Element	**Factor**	**Amount**	**Change in total**	**%Change**	**Comment**
Equipment		6,084.4			
	×5%		54412.29	0.6%	More sensitive
	÷5%		175796.07	224.9%	
	×10%		54168.91	0.11%	More sensitive
	÷10%		662548.07	1124.5%	
	×15%		54168.914	0.11%	Less sensitive
	÷15%		54513.69667	0.75%	

Table 6: Sensitivity analysis of key cost inputs using Length stay Factors of 3 and 15 (days)

Element	Factor	Amount	Change in total	% change	Comment
Equipment	×2	6,084.4	**66,394.45**	22%	More sensitive
	÷2		**51,183.45**	-4%	
	×3		**72361.2**	34%	More sensitive
	÷3		**74389.4**	-96%	
	×15		**145374.07**	169%	More sensitive
	÷15		**54513.697**	0.75%	
Personnel	×2	32,300.4	**118,362.91**	118%	More sensitive
	÷2		**37,611.91**	-31%	
	×3		151009.27	179%	More sensitive
	÷3		**64874.87**	16.60%	
	×15		**538614.07**	895%	More sensitive
	÷15		**56261.43**	3.98%	
Utilities	×2	11,028.66	**65,254.31**	20%	
	÷2		**48,711.32**	-10%	More sensitive
	×3		**87194.05**	61%	
	÷3		**57784.29**	6.8%	More sensitive
	×15		**219537.97**	30574%	
	÷15		**54843.314**	1.4%	More sensitive
Drugs	×2	3,367.53	**57,593.18**	6%	
	÷2		**52,541.88**	-3%	Less Sensitive
	×3		**55230.58**	2.1%	Less sensitive
	÷3		**55230.58**	2.1%	
	×15		**54108.07**	0%	Less sensitive
	÷15		**54332.57**	0.4%	
Supplies	×2	1278.70	**55,504.35**	2%	Less sensitive
	÷2		**53,586.30**	-1%	
	×3		**57944.17**	7.1%	Less sensitive
	÷3		**54534.96**	0.01%	
	×15		**73288.57**	35.4%	Sensitive
	÷15		**54193.32**	0.16%	

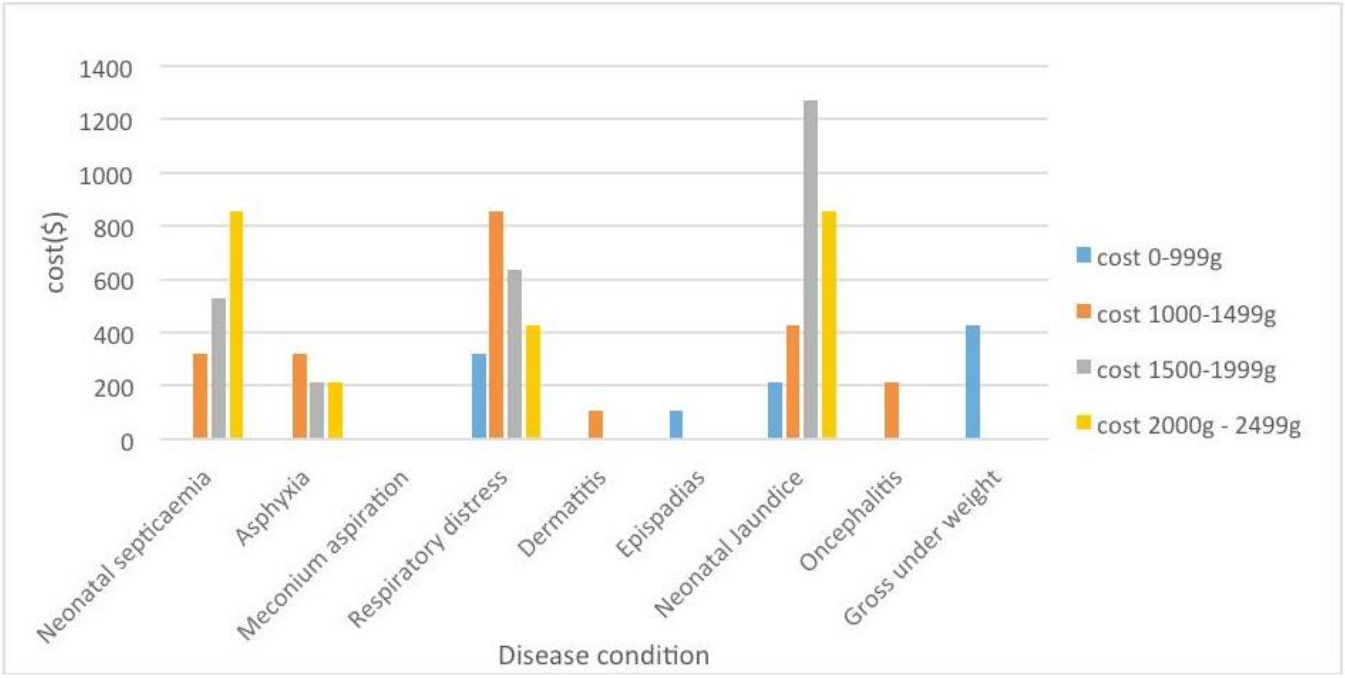

Figure 1: Costs by weight and disease conditions (morbidities) preterm infants suffered during the period of August 2015 to July 2016