

Perception of the healthcare providers on the cost of commonly used consumable items in the Neonatal Intensive Care Units at Delhi / NCR, India

Priyanka Gupta^{1*}, Shalu Sharma¹, Mitasha Singh² and Ranabir Pal²

¹Department of Paediatrics, ESIC Medical College and Hospital, NIT-3, Faridabad, Haryana, India and ²Department of Community Medicine, ESIC Medical College and Hospital, NIT-3, Faridabad, Haryana, India

Abstract: *Background:* Consumable items used in NICU contribute to a significant proportion of the total cost of care. *Objectives:* To learn about the cost perceptions of NICU healthcare providers for some commonly used consumable items. *Methods:* This cross-sectional study was carried out in eight NICUs of corporate hospitals in the Delhi/NCR, India. A total of 191 doctors and nurses estimated the maximum retail price (in Indian National Rupees) of 18 commonly used consumable items. Estimated or perceived cost was taken as correct if it was within $\pm 10\%$ of the actual cost. *Results:* Out of total 3438 responses, only 9% estimates were correct. Females reported a significantly higher proportion of correct estimates as compared to males (9.8% vs. 6.3%; $P=0.01$). Nurses were observed to report significantly higher proportion of correct estimates as compared to doctors (10.0% vs. 6.6%; $P=0.003$). No relationship could be established between the misperceptions about the cost with age of the healthcare provider or with the duration of NICU work experience ($P \geq 0.05$). *Conclusion:* Just like other regions, healthcare providers including doctors in our region were unaware of the true cost of commonly used consumables in NICU while nursing personnel had marginally better internalization.

Keywords: Consumable items, cost awareness, cost perception, doctors, neonatal intensive care units, nurses.

Introduction

Over past few decades, there have been many advances in the field of Neonatology with better survival rates of even the sickest of newborns at highly equipped Neonatal Intensive Care Units (NICUs). However, nothing comes without a price tag and the cost of medical care in NICUs is rising day by day across the world [1-9], including India [1, 5].

Consumable items used in NICU contribute to a significant proportion of the total cost of NICU care, sometimes even up to 56% especially when these consumable items are the imported ones [3, 10]. When we scrutinized thirty randomly selected NICU bills from corporate hospitals in Delhi/NCR generated over last one-year, consumable items were found to contribute up to 39% of the total NICU bill.

In 2007, Allan GM, et al [11] did a systematic review and noted that the doctors have a poor understanding of pharmaceutical cost. In most of the cost accuracy studies, cost of inexpensive

products was overestimated and vice versa. Further, doctors working in NICU and other emergency settings were frequently unaware of the actual cost of consumables also used by them [12-13]. The perception of the cost of these consumable items by the healthcare providers working in NICUs may have relevance to the expenditure incurred, optimum utilization of resources and the empathetic attitude toward the family who is paying for it in the private sector.

We hypothesized that the perceptions of cost may be better in the healthcare providers of corporate sector in our region because here the patient directly pays for it and there is always an ongoing conversation between the patient's relatives and NICU staff on daily basis. This study was planned to find cost perceptions of 18 commonly used consumable items by the healthcare providers (doctors/ nurses) working in the NICUs of corporate sector, and to relate misperceptions (if any) with the participant characteristics.

Material and Methods

This cross-sectional study was carried out during year 2017 (before the introduction of Goods and Service Tax) in eight NICUs of big corporate hospitals at Delhi/NCR, India, having both invasive and non-invasive ventilation facility and who consented to be the part of this study. Study protocol was approved by the Institutional review board and Ethics committee. Permission to collect data was obtained from the concerned authorities of these eight NICUs with commitment not to disclose their hospital/staff name. All doctors and nursing staff were enrolled with their informed consent. Based on the results of previous published report by Geoghegan AR *et al*, [12], a minimum sample size of 87 was calculated. However, an attempt was done to include all doctors and all nurses working in these eight NICUs due to the concern of around 50% non-response rate.

Each participant was asked to give their personal details viz. age (in completed years), gender, academic degrees, designation and total experience of working in the NICUs (in completed months). They responded with perceived MRP i.e., estimated MRP (maximum retail price) in Indian National Rupees for 18 commonly used consumable items, independent of each other. Consumable items included gloves, syringes, IV cannula, 3-way stopcock, extension line, PMO line (pressure monitoring line), IV fluid burette, suction catheter, infant feeding tube, urine collection bag, transparent adhesive dressing for IV cannula, eye protective patch, endotracheal tube, umbilical catheter, PICC line (percutaneous intravascular central catheter), complete bubble CPAP (continuous positive airway pressure) circuit and disposable ventilator circuit. Technical specification of each of these items were given along with to have uniformity in replies.

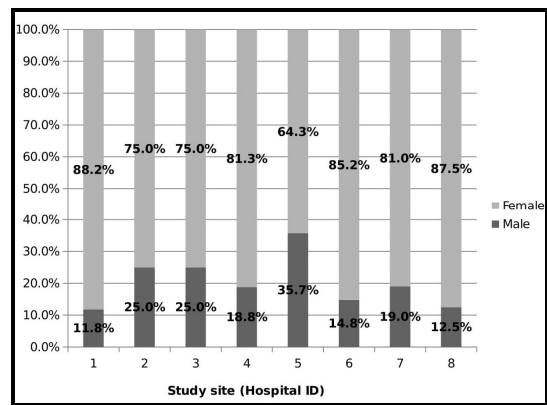
The data was numerically coded and entered in Microsoft Excel 2007 and then transferred to SPSS (version 18.0) software. A comparison of the perceived/ estimated cost and the actual cost was made for all 18 consumable items for each of the participant. Perceived cost was taken as correct if it was within $\pm 10\%$ of the actual cost. Box and whisker plots of the participant estimates of the cost were made. Chi-square, Independent T-test and Mann-Whitney U test were applied to

understand relationship between misperceptions about the cost and gender, designation, age and total duration of NICU work experience.

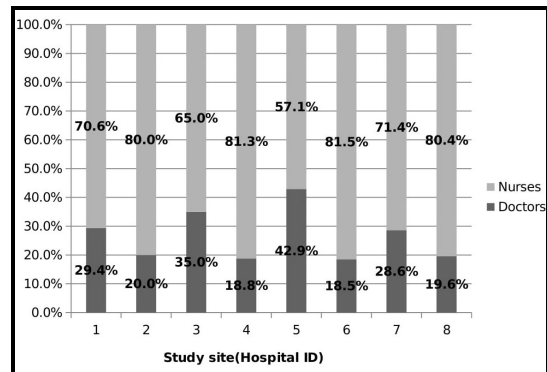
Results

A total of 191 doctors/ nurses working in the NICUs of eight different hospitals consented to be the part of study. Out of 191 participants, 35 (18.3%) were males and 156 (82.7%) were females; 47 (24.6%) were doctors and 144 (75.4%) were nurses [Figure 1(a-b)].

Fig-1(a-b): Subject Characteristics



(a)

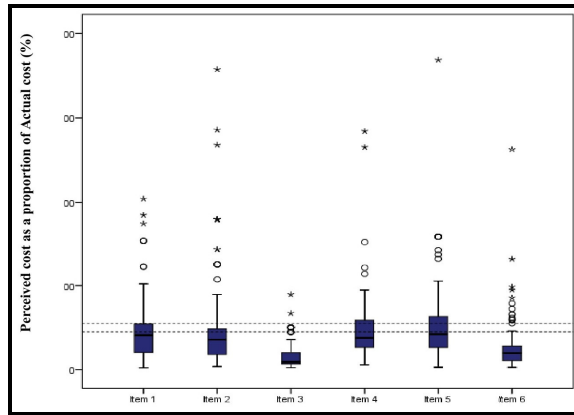


(b)

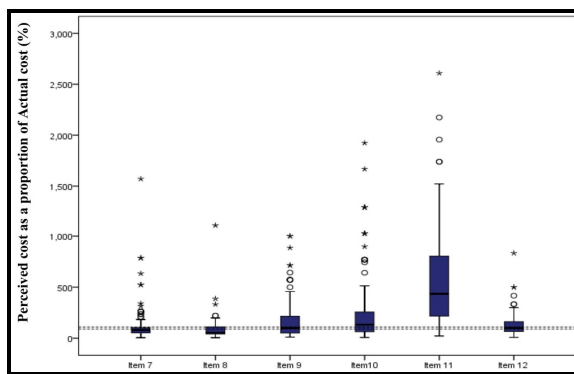
Perceived/ Estimated Cost of Consumable items: Box and Whisker plots of perceived/ estimated costs for all 18 consumable items showed that the cost of most of the items including gloves, syringes, IV cannula, IV fluid burette, eye protective patch, umbilical catheter, PICC line, bubble CPAP circuit and disposable ventilator circuit were generally underestimated and that of few items like suction catheter, infant feeding tube, urine collection bag, transparent adhesive dressing

for IV cannula and endotracheal tube were commonly overestimated. Overall, there was a tendency to underestimate cost [Figure 2 (a-c)].

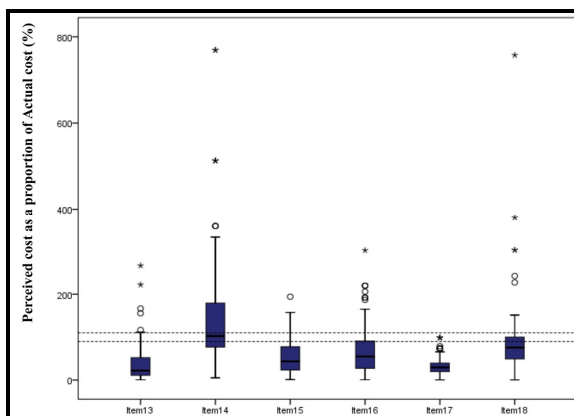
Fig-2 (a-c): Box and Whisker plots showing the perceived/ estimated costs as a proportion of actual costs



(a)



(b)



(c)

Correct/ Wrong perception of the cost: Overall, out of total of 3438 responses (191 subjects × 18 items), only 316 (6.6%) estimates were correct. Item-wise distribution of frequency and proportion of correct estimates is presented in

Table 1. The extension line for IV cannula followed by 100-mL IV fluid burette and bubble CPAP circuit were the most commonly misperceived cost items. Although far from satisfactory, disposable circuit of the ventilator was the item whose cost was correctly perceived at best by 28% participants [Table 1]. There was an overall tendency to misperceive the cost of consumable items in staff from all hospitals; significance of difference in standard error of proportions for overall correct and incorrect estimates <0.001 for all the 8 hospitals. Cumulative correct perception of the costs was as low as 4.4% to be as best to be 23% among eight different NICUs.

Perception of cost vs. Gender of the healthcare provider: Among 35 male healthcare providers, the proportion of correct cost estimate for various consumable items ranged from 0-20%. None of the male healthcare provider had correct perception of cost for syringes (10 and 50 mL), extension line for IV cannula, eye protective patch and bubble CPAP circuit. Their perception was at best for item no.7 i.e., PMO line, however that's too correct only among 20%. Among 156 females, the proportion of correct cost estimates was variable from 0.6% to 31.4%, lowest for extension line for IV cannula and highest for the disposable ventilator circuit, respectively. When all 3438 responses (191 participants × 18 items) were considered, females reported a significantly higher proportion of correct cost estimates than males (9.8% vs 6.3%; P = 0.01; Chi square test).

Perception of cost vs. Profession category: Overall proportion of correct cost estimates was higher in nurses compared to doctors (10.0% vs 6.6%; P=0.003; Chi square test). Among doctors, none perceived correct cost of syringes (10 and 50 mL), extension line for IV cannula, eye protective patch and CPAP circuit. PMO line was the item whose cost awareness was best in doctors, 27.7% doctors giving correct cost estimate for the PMO line. Among nurses, the proportion of correct cost estimate was highest for the disposable ventilator circuit (32.2%); and least for extension line for IV cannula (only 0.7%).

Perception of cost vs. age and duration of work experience of the healthcare provider: Mean age was compared between the two groups with correct and incorrect cost estimates using Independent T-test and was found to be comparable in the two groups (28.94±4.94 and 29.04±5.39 years respectively; P≥0.05). The median and IQR for the duration of NICU work experience were 42 (24-84) and 41 (18-74)

months in the two groups with correct and incorrect cost estimates, respectively. Even the duration of NICU work experience was comparable between the two groups (P≥0.05, Mann-Whitney U test). Thus, no relationship could be established between the misperceptions about the cost with age of the healthcare provider, or with the duration of NICU work experience.

Table-1: Item-wise frequency and proportion of correct cost estimates (perceived cost as a proportion of actual cost ± 10%)

Sl. no.	Consumable Item	Correct Estimate N (N/191%)	Incorrect Estimate N (N/191%)	P value*
1	Sterile pair of surgical gloves (size 7)	6 (3.1)	185 (96.9)	<0.001
2	Syringe 10 mL	9 (4.7)	182 (95.3)	<0.001
3	Syringe 50 mL	7 (3.7)	184 (96.3)	<0.001
4	IV cannula (24 G)	20 (10.5)	171 (89.5)	<0.001
5	3-way stopcock	10 (5.2)	181 (94.8)	<0.001
6	Extension line- 15 cm long with needle free hub (polyurethane)	1 (0.5)	190 (99.5)	<0.001
7	PMO line-200 cm (polyurethane)	49 (25.7)	142 (74.3)	<0.001
8	IV fluid Burette (100 mL)	4 (2.1)	187 (97.9)	<0.001
9	Suction catheter (12 Fr, PVC)	15 (7.9)	176 (92.1)	<0.001
10	Infant feeding tube (8 Fr, PVC)	15 (7.9)	176 (92.1)	<0.001
11	Urine collection bag (capacity 100 mL)	15 (7.9)	176 (92.1)	<0.001
12	Non-padded transparent adhesive dressing for IV cannula	31 (16.2)	160 (83.8)	<0.001
13	Eye protective patch (medium size 25-33 cm)	8 (4.2)	183 (95.8)	<0.001
14	Endotracheal tube- 3 mm (uncuffed, without stilette)	42 (22.0)	149 (78.0)	<0.001
15	Umbilical Catheter (3.5 Fr- polyurethane)	9 (4.7)	182 (95.3)	<0.001
16	PICC line (24 G- polyurethane)	17 (8.9)	174 (91.1)	<0.001
17	Disposable Bubble CPAP set- Infant delivery system with nasal prongs, nasal tube and infant bonnet (Fisher and Paykel)	4 (2.1)	187 (97.9)	<0.001
18	Disposable Ventilator circuit- Draeger Babylog 8000 model (Fisher and Paykel)	54 (28.3)	137 (71.7)	<0.001
Total		316 (9.2)	3122 (90.8)	<0.001

*Significance of difference in standard error of proportions

Discussion

In a report from Ireland by Geoghegan AR *et al* [12], in which cost perception of 20 commonly used consumable items used in NICU was studied among 21 doctors, it was found that only 6% cost estimates were correct, and the doctors were highly unaware of the correct cost of consumable items. They considered the cost estimate to be correct if it was within ±10% of the actual cost.

There is another recent Canadian study [13] published in 2017 in which 124 emergency department physicians from two tertiary teaching hospitals estimated cost of 41 common medicines, materials used, imaging tests and drugs i.e., they studied cost perception under four categories. Estimates were considered correct in their analysis if it was within ±25% of the actual cost. The average percentage of correct cost estimates

among this group of physicians was 14% across the four categories.

In our study, only 6.6% cost estimates by the doctors were correct which agreed with the findings of Geoghegan, et al [12]. Overall among the healthcare providers (which include nurses as well as doctors), 9.2% costs estimates were correct. The variable results could be explained due to regional and population characteristics and the fact that there is no uniformity is the definition of 'correct cost estimate' which has been variably taken as correct from ± 10 to $\pm 25\%$ of actual cost in different studies.

Disposable ventilator circuit was the item whose cost was estimated most precisely among all items; correct response by more than 1/4th of the participants. Nurses were found to be much more aware of the costs than doctors. Females were found to have better knowledge about the correct cost than males. Both these relationships were statistically significant. There was no significant relationship of perception of cost of consumable items with the age of healthcare provider or the duration of NICU work experience. Overall, there

was a tendency to underestimate the cost of most of the items.

Conclusion

Unfortunately, during the traditional medical and nursing training, doctors and nursing staff are not given any priming about any of the aspect of health economics and there are huge shortcomings in this regard. Just like any other regions, doctors in our region too are unaware of the actual cost of commonly used consumable items in NICU, though nurses have a slight better understanding of the cost. Whether the cost is borne is by the government or by the patient, there is a sincere felt need to learn it. This learning would help in better utilization of resources as well as developing an empathetic attitude toward the family who is paying for it in the private sector. Health economics and Healthcare management should be added to undergraduate and postgraduate teaching-learning programs for doctors and nurses so that our healthcare providers can provide cost-effective interventions at each level.

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*All correspondences to: Dr. Priyanka Gupta, Professor, Department of Paediatrics, ESIC Medical College and Hospital, NIT-3, Faridabad, Haryana, India. E-mail: drpriyankaguptakapil@gmail.com