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Original Article

Paediatrics Section

Cost-Effective Recruitment need for 24x7 Paediatricians in the State General Hospitals in Relation to the Reduction of Infant Mortality

RANJANA CHATTERJEE[1], SUKANTA CHATTERJEE[2]

ABSTRACT

Introduction: According to World Health Organisation (WHO), improvement of hospital based care can have an impact of upto 30% in reducing Infant Mortality Rate (IMR), whereas, strengthening universal outreach and family-community based care is known to have a greater impact. The study intends to assess how far gaps in the public health facilities contribute towards infant mortality, as 2/3rd of infant mortality is due to suboptimum care seeking and weak health system.

Aim: To identify cost-effectiveness of employment of additional paediatric manpower to provide round the clock skilled service to reduce IMR in the present state health facilities at the district general hospitals.

Materials and Methods: A cross-sectional observational study was conducted in a tertiary teaching hospital and district hospitals of 2 districts (Hooghly and Howrah in West Bengal). Factors affecting infant mortality and shift wise analysis of proportion of infant deaths were analysed in both tertiary and district level hospitals. Information was gathered in a pre-designed proforma for one year period by verifying hospital records and by personal interview with service personnel in the health establishment. SPSS software version 17 (Chicago, IL) was used. The p-value was calculated by Fischer exact t-test.

Results: Available hospital beds per 1000 population were 1.1. Percentage of paediatric beds available in comparison to total hospital bed was disproportionately lower (10%).

Dearth of skilled medical care provider at odd hours in district hospitals resulted in significantly greater infant death ($p < 0.0001$), but was not seen in tertiary hospital. The investment for appointing four additional paediatricians for round the clock stay duty was found to be cost-effective.

Conclusion: Provision of round the clock availability of skilled medical care may reduce hospital based infant mortality and it is cost-effective.

Keywords: Bed per thousand populations, Hospital based care, Infant mortality rate, Paediatric bed percentage

INTRODUCTION

India is striving to reach the fourth Millennium Development Goal (MDG) by its Tenth Five Year Plan, which states reduction of Infant Mortality Rate (IMR) to 45/1000 by 2007 and 28/1000 live births by 2012 [1]. However, India is trailing behind. According to World Health Organisation (WHO), improvement of hospital based care can have 30% impact in reducing IMR whereas strengthening universal outreach and family-community based care have higher impact [2]. In the current scenario, 2/3rd of the IMR is accounted by Neonatal Mortality Rate (NMR). Most neonatal deaths in low/middle income countries (99% of neonatal deaths) are the result of suboptimum care seeking and weak health system. It is hypothesized that certain minor changes, in the present health system could modify the alarming IMR [3]. We propose two changes: round the clock availability of skilled paediatric medical professional to provide 24x7 uniform quality of medical care and increase of paediatric beds proportionate to the population in hospitals having separate paediatric ward to prevent refusal of admissible cases.

The diurnal or shift wise variation of mortality was mentioned by Coiera E et al., in general indoor patients from 501 hospitals data in Australia. Their data indicated higher mortality in the evening and lowest in the morning and it was suggested to be due to reduced availability or quality of clinical care [4]. Aldridge C published similar effect of increased hospital mortality at weekend in the England hospitals due to lack of specialist service [5]. Although there is dearth of data on diurnal mortality in general paediatric wards or hospitals, there are many reports indicating no significant variation in diurnal mortality where quality clinical services are available round the clock for critical patients [6-8]. The present IMR status calls for newer approaches that go beyond disease or programme specific approaches as mentioned more than a decade back in the WHO Bulletin 2000 still holds good [9]. It is a fact that the adaptation of any health intervention in the developing countries like India often loses priority unless it is cost-effective.

With this idea in mind, this study was planned to identify cost-effective interventions in health facilities to reduce IMR further that can be readily implemented in the existing public health system in West Bengal, India.

AIM

To identify cost-effectiveness of employment of additional paediatric speciality manpower required for provision of 24x7 quality clinical care to reduce diurnal variation of IMR in the present district level general hospitals.

MATERIALS AND METHODS

A cross-sectional observational study was conducted in a tertiary teaching hospital (Kolkata) and in the district and sub-division hospitals of two districts namely Hooghly and Howrah. The tertiary teaching hospital in Kolkata was randomly tagged for referral services with these two district hospitals by the state health authority. Rural hospitals, BPHC and primary health centres were excluded. We observed the material infrastructure, human resource and service pattern in the district set up and tertiary care teaching hospital and assessed the different variables influencing infant deaths within the same hospitals. Health facilities were visited with prior intimation with the administration. Information about IMR was collected by verifying the records of the hospitals for a period of one year (April 2009-March 2010) in all the health establishments by visiting them in August and September 2010.

Personal interview with service personnel (paediatrician, on-call medical officer from general emergency, nurses and group D staff of paediatrics ward) and also the chief medical officer of health for the districts of the health establishments were included using a predesigned proforma. Among the service care providers the number of skilled medical care providers (paediatricians/ postgraduate trainee), nurses and group D staff per shift were recorded. Besides this, information about total hospital beds, percentage of paediatric beds, total admissions in paediatric ward and new-born delivered/year was gathered. Total population and available beds per 1000 population were collected from the state health publication [10]. Institutional ethical committee clearance was sought prior to initiation of the study.

STATISTICAL ANALYSIS

Data was presented as ratios or percentage. The relationship of various factors was presented by odds ratio and 95% confidence interval. The p-value was calculated by Fischer exact t-test. SPSS software version 17.0 (Chicago, IL) was used. The $p < 0.05$ was considered significant.

RESULTS

Three hospitals data were included - two district hospitals, Howrah and Hooghly along with one medical college hospital of Kolkata. Two sub-division hospitals' data were not included for diurnal mortality since there was no paediatrician posted in these hospitals.

Bed per 1000 population in the Howrah and Hooghly district was 1.15 and 1.1, respectively [Table/Fig-1]. Material infrastructure wise and manpower wise district and sub-division hospitals were deficient in comparison with tertiary hospitals. Proportionate share of paediatric bed with respect to total hospital beds in district and tertiary hospital was less than 10%. In district level hospital, on-duty paediatricians are involved in the patient care in the morning shift only. In the evening and night shifts, the paediatric indoor as well as emergency cases are attended by the Emergency Medical Officer (EMO). On call paediatrician occasionally visited in the evening [Table/Fig-2]. The incidence of deaths in the evening shift and night shift in these district level hospitals were 1.92 and 1.88 times higher than that of morning shift respectively. The difference is statistically significant ($p< 0.0001$). There was a significant difference in the incidence of deaths between morning and evening ($p< 0.0001$) and morning and night shifts ($p < 0.0001$) in these hospitals [Table/ Fig-3]. Though proportion of infant deaths were found to be high in the night shift in tertiary care hospital they were not statistically significant in comparison to other shifts. The proportion of infant deaths in night and evening shift is significantly greater than that of the morning shifts in district hospitals. Tertiary hospital fails to show any such significant shift-wise difference.

Parameters	Howrah district	Hooghly district
Total bed	450	492
Total paediatric bed (%)	43 (< 10)	35 (7)
Admission age in paediatric ward	10 y	10 y

[Table/Fig-1]: Bed strength and number of admissions in the study hospitals (Total two hospitals i.e., the District Hospital of each of two districts).
Paracentesis include approximate percentages. Recommended paediatric share of total hospital beds is 30%. The percentage paediatric share of beds that is sanctioned and thus functioning is far less than the recommended.

Shifts	Morning (% IMR) Paediatrician/Nurse/ Group D staff	Evening (% IMR) Paediatrician/Nurse/ Group D staff	Night (% IMR) Paediatrician/Nurse/ Group D staff
District hospitals	Yes/Yes/Yes (18.07%)	No/Yes/Yes (41.6%)	No/Yes/Yes (40.33%)
Tertiary hospital	Yes/Yes/Yes (27.39%)	Yes/Yes/Yes (34.35%)	Yes/Yes/Yes (38.26%)

[Table/Fig-2]: Comparison of percentage IMR and skilled human resource in study hospitals.
Morning shift 9 AM -3PM, Evening 3PM-10PM and Night 10PM-9AM.
Yes means all the 3 category staffs were present in the paediatric ward/paediatric emergency; 'No' means the concerned staff were absent.

Comparision of Proportion of Infant Mortality between the Shifts in District Hospital and Tertiary Hospital			
Shifts	Total death and (%)	Odd's Ratio (95% CI)	p-value
Morning & evening (District Hospital) (Tertiary hospital)	43(18.07) vs 99(41.6) 63(27.39) vs 79(34.35)	1.92 (1.392 – 2.647) 0.79 (0.66-0.95)	<0.0001 0.226
Morning & night (District Hospital) (Tertiary hospital)	43(18.07) vs 96(40.33) 63(27.39) vs 88(38.26)	1.88 (1.36 – 2.59) 0.76 (0.61-0.85)	<0.0001 0.232
Evening & night (District Hospital) (Tertiary hospital)	99(41.6) vs 96(40.33) 79(34.35) vs 88(38.26)	0.97 (0.77 – 1.24) 0.89 (0.79-1.01)	0.865 0.220

[Table/Fig-3]: Shift wise analysis of proportion of infant deaths in study hospitals.

DISCUSSION

Infant mortality is an accepted indicator of the health status in a given population. The bed per 1000 population in the Howrah and Hooghly districts were 1.15 and 1.1, respectively [10]. The bed: population ratio of India is around 1/1000 while the corresponding figures for Kerala which is a better performing state is 3.3/1000 population. The IMR of India as of 2014 SRS is 40 deaths/1,000 live births, of West Bengal is 31/1000 which is much higher than the other better performing state of India, namely Kerala whose IMR is 12/1000 live births [11]. The report shows a slow trend of reduction of IMR (India: West Bengal: Kerala) from 2010 (47:31:13) to 2014. The rate of decline of IMR over decade is getting slower probably due to the better initial response of proven community based measures on the health system but gradually reaching a slower plateau of the curve. It is known that non-institutional public health factors influence IMR more than the institutional care. This may indicate the possibility of other factors having impact on the IMR.

A Brazilian study [12] revealed that availability of hospital beds was associated with lower IMR and is consistent with the fact that IMR is strongly influenced by the availability and quality of health care. According to 2011 census, population up to 14 years of age is 31.6%. The higher frequency and severity of illnesses in children needs around 30% share of beds for paediatrics in a General Hospital. Proportionate paediatric share of total beds in both the district and tertiary hospital is less than 10% in our study. This disparity in paediatric bed: total bed leads to overcrowding, bed sharing, flooring or refusal of admissions that adds to IMR. Therefore the study indicates a need to increase total paediatric bed share that might help to improve the quality of health service and reduce the IMR in the facility based care.

Studies reveal that health service indicators (physicians and nurses per 10, 000 population, and hospital beds per 1000) are important independent variables known to influence infant mortality rates [12]. There are other reports [13-15] indicating that quality of care and the mortality rate of patients depends on availability of in-hospital medical manpower. The weekend and diurnal mortality variation, although not paediatric specific, was reported by Coiera E in hospital patients [4]. In-hospital and on call availability of doctors were compared by Nishisaki A and Gajic O [14,15].

The present study results show that the district hospitals are well short of the health care personnel and have to cope with considerable demand for services. The drop in skilled emergency care during odd hours is reflected by significantly higher proportion of infant deaths in the evening and night shifts when compared with that of morning shift ($p <0.0001$) in the district level hospital. On the contrary, similar analysis in tertiary care hospital revealed higher proportion of infant deaths in the night shift but they were not statistically significant in comparison to other shifts. This may be explained by the round the clock hospital stay duty by paediatricians in tertiary hospital. This concept is supported by the reports of Wise KR and Mcshane P [16,17]. Although the results of a paediatrician service is not exactly

compared within a general hospital setting like district hospital in the above studies, a critically ill or moribund infant or neonate cannot be properly treated or revived by an emergency medical officer or general duty medical officer or other category staff in absence of a skilled paediatrician in district hospitals. Sending call-book to an on-call paediatrician, who is at residence or outside at odd hours, cause irreversible delay in the critical care thus adding to IMR.

Thus, our study indicates the need to increase the number of skilled medical personal. A hypothesis can be built that presence of paediatrician at odd hours can reduce infant mortality. For this round the clock hospital-stay duty by paediatricians at all district/ sub divisional hospitals having paediatric in-patients ward is required. Infant health is dependent on contact with health care services and at the same time infant mortality is an indicator of the effectiveness of services. Lagos et al., revealed that physicians in low-income countries, primarily African countries, save about three times the number of lives as do nurses, while their salaries are twice as high as nurses' salaries [18]. This finding suggests that investing in physician training can make a significant contribution to primary health care in low-income countries. Cooper RA reported better quality health care with more physicians [19]. De Maeseneer J reported the positive effect of physician service in primary care by saving life [13]. Castillo concluded in his study that investing on health workers reduces burden of disease [20]. Musgrove P mentioned that investing on trained specialist saves more life in critical patients in hospitals [21]. Banerjee R described cost-effectiveness of specialist care in reducing mortality in the night shift in a critical care setting [22]. Parikh A demonstrated quality improvement and cost savings in physician staffing in community hospital setting [23].

If we consider reduction of the shift-wise variation of infant mortality in the district and sub-divisional hospital by providing a round the clock in-patient and emergency service by trained paediatrician, it needs at least four additional paediatricians appointment in addition to the existing strength. If we assume monthly average salary of a paediatrician Rs 50000/-, the cumulative cost for the service comes around Rs- 2400000/- (twenty four lacs) per annum. The annual increment and cost of allowances and benefits will add on around 15% on the total for every year leading to 15x66.4% i.e., approximately ten times of present salary or Rs 2,400,000 (2.4 crores). The average life expectancy at birth is 66.4years in India (2013) and GNI (Gross National Income), previously called GNP (Gross National Product) is USD 1570 (2014), equivalent to Rs- 105190/-. Assuming that there would be same proportion of mortality in other shifts as prevailing in morning shift (43 per year) by the provision of 4 additional paediatrician, 109 lives/year will be saved, and this 109 infant may add Rs 761,323,144/-(105190× 109×66.4) or seven thousand six hundred and thirteen crore approx. to the GNI, if they survive 66.4 years. This calculation was based on UNICEF reference model [24]. It is worth to mention that this cost-effectiveness calculation is not so simple since in the next 66.4 years the salary expenditure will increase further by pay commission recommendations and the increase of GNI per capita will add on to the savings to neutralise the expenditure.

With this background, in our scenario to start with creation of at least four additional post of paediatrician at all district hospitals can be made to ensure round the clock skilled medical care. This investment for appointing four paediatricians is found to be cost-effective when their average annual salaries, as exist in the present health system, was compared to the number of lives saved annually in relation to the gross national income and the average life expectancy in India.

LIMITATION

The study was done in two district hospitals and compared with only one tertiary care hospital. We have taken into consideration only four parameters in our study to affect IMR though there are many other factors influencing IMR. Thus further large scale studies are required to develop any recommendations.

CONCLUSION

The strategy to reduce IMR is to increase available hospital beds per 1000 population and its population-proportionate paediatric share. Round the clock availability of skilled medical care is shown to reduce hospital based infant mortality and it is cost-effective.

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PARTICULARS OF CONTRIBUTORS:
1. Professor, Department of Paediatrics, University College of Medicine & JNM Hospitals, Kalyani, Nadia, West Bengal, India.
2. Professor, Department of Paediatrics, KPC Medical College, Jadavpur, Kolkata, West Bengal, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Sukanta Chatterjee,
889A Lake Town, Kolkata – 700089, West Bengal, India.
E-mail: sukantachatterjee@hotmail.com

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