



## Review Article

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# Variation in Utilisation of NICU Across Tertiary Care Centers in Alain Region of Abudhabi, UAE: A Review

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## Abstract

**Objectives:** The current study was designed to evaluate the variation in patterns of admission of term and preterm infants across two tertiary care NICUs in Al Ain region of Abu Dhabi, UAE.

**Methods:** This study represents a population based examination of the epidemiological trends of NICU admissions over a two-year period between 1st January 2017 to 31st December 2019 at 2 tertiary care NICUs in the Al Ain region of Abu Dhabi UAE. A detailed form was created to collect information from the patient's electronic medical records. Data were analyzed using IBM SPSS Statistics for Windows, Version 23.0 (IBM Corp., Armonk, NY).

**Results:** A total of 1077 babies were admitted in the study period, with mean maternal age of  $31.14 \pm 5.76$  years. Majority 76.6% were multigravida, and 42.3% had spontaneous vaginal delivery. Among the admitted neonates, 56.8% were male babies. 483 babies had birth weight more than 2.5 kg while 594 had lower than 2.49 kg out of which 76 babies had birth weight less than 1 kg. 39.64% of the babies were >37 weeks' gestation while 64.06% were less than 36 weeks. Only 14.4% required ventilation after initial oxygen support at birth. Regarding the primary diagnosis, 64.06% were admitted as case of prematurity, 22% term babies were admitted with different illness, 10.7% were with different congenital anomalies, and 3.24% with proven infectious diseases. The mean stay in NICU was  $24.17 \pm 42.73$  days, with minimum of 5 hours of stay to maximum of 390 days.

**Conclusion:** There needs to be a solidified effort in trying to focus neonatal care teams on using the NICU wisely so that appropriate use of intensive care for sick newborn infants can be assured. Also it needs to account to the local context and the needs of families. Regularization of monitoring and creation of an intermediary unit or transitional care units between mother and baby units and NICU for monitoring of babies could have a momentous impact, both on minimizing the length of stay in term and preterm neonates as well as use of NICU beds.

**Keywords:** Neonates; NICU; Admission; Sepsis; Preterm

## Introduction

NICUs are built to treat sick newborns in the first month of life. It is assumed that certain degree of prematurity requires NICU stay secondary to the need of respiratory support, monitoring of apneas and nutritional support in the context of their inability to orally feed. UAE is one of the rapid developing nations, experiencing fast transformation especially with rapid advances in the medical field. Extensive variation in admission rates at NICUs in various intensive care units across the UAE has been found. Preterm births are associated with high morbidity and mortality rates. Preterm births were reported up to 6.3% in previous studies in UAE [1], while low birth weight rate has been reported as 9.4%, which is less than in

adjacent nations of Yemen and Oman with rate of 18% and 13.7% respectively [2,3]. Other issues such as Low birth weight is mostly the consequence of preterm birth or due to other reasons such as intrauterine growth restriction [4]. Infants with low birth weight are greatly exposed to various health concerns like delay in growth, contagious infections and growth retardation, that may happen in early stages of life, infancy and eventually in late periods of life [5]. Term babies may also need to be admitted for other medical diagnoses including disorders that require intensive care management like septic shock, surgical emergencies such as volvulus or critical congenital heart disease that affect perfusion. Magnitude of bed uti-

lization per gestational age groups is an important data to be evaluated in every health care system which will help in quality improvement initiatives, cost cutting and efficiency. Data on bed, resource utilization and admission rates of preterm and term babies to the NICU in different neonatal units in the UAE is lacking. Therefore, the current study was aimed to describe the characteristics of babies admitted to tertiary level NICUs at Tawam hospital and Al Ain hospital, in Abu Dhabi region of UAE.

## Material and Methods

This was a retrospective study which included all babies admitted to the NICU in Tawam hospital and at Al-Ain hospital from 1<sup>st</sup> January 2017 to 31<sup>st</sup> December 2019. The study was conducted after approval from the ethics committee. A detailed data sheet was created to collect information from the patient's electronic medical records. Names and patient IDs were concealed. All physicians participating in the study submitted data on all infants admitted to their respective NICUs using uniform definitions including transfer to other centers. All data underwent check for quality and completeness of data manually by the primary investigator.

Any initial resuscitation included oxygen, mask/endotracheal ventilation, nasal continuous positive pressure, epinephrine, cardiac compressions, surfactant immediately after birth. Ventilation after initial resuscitation included conventional ventilation and high frequency ventilation. Hypoxic ischemic encephalopathy was only measured among infants at least 36 weeks gestational age. Extreme prematurity was defined as gestational age less than or equal to 27 weeks. Very preterm infants were defined as gestational ages between 28 weeks 0 days to 32 weeks and 6 days. Preterm infants

were defined gestational ages between 33 weeks 0 days and 34 weeks 6 days. Late preterm infants were defined as those between 35 weeks 0 days till 36 weeks 6 days. Early term infants were those between 37 weeks 0 days till 38 weeks 6 days. Term infants were those babies between 39 weeks 0 days till 40 weeks 6 days. Post term infants were those babies above or equal to 41 weeks.

High acuity was defined for infants born more than or equal to 34 weeks gestational age as follows: death, intubated or ventilated more than 48 hours, early bacterial sepsis, major surgery requiring anesthesia, transport to other center for surgical or medical services, HIE, 5 minute Apgar less than 5, therapeutic hypothermia. Length of stay was measured as the number of days from when the baby was admitted until the date of initial discharge from the hospital, transfer or death. Short stays were defined as infants more than equal to 34 weeks gestational age who were inborn and who stayed 1-3 days and were discharged from the hospital.

Data were analyzed using IBM SPSS Statistics for Windows, Version 23.0 (IBM Corp., Armonk, NY). Continuous variables will be reported as mean and standard deviation and categorical variables as number (percent). Chi-square test and Pearson's correlation test will be applied. The level of significance was set at  $P < 0.05$ .

## Results

A total of 1077 babies were admitted in the study period, with mean maternal age of  $31.14 \pm 5.76$  years, with age range from 20-50 years. 85.6% were Emirati babies admitted to our unit primarily because we serve the national population mainly. Majority of the mothers were multigravida [76.6%], and 42.3% of them delivered via spontaneous vaginal delivery (Table 1).

**Table 1:** Maternal characteristics of NICU admission (n=1077).

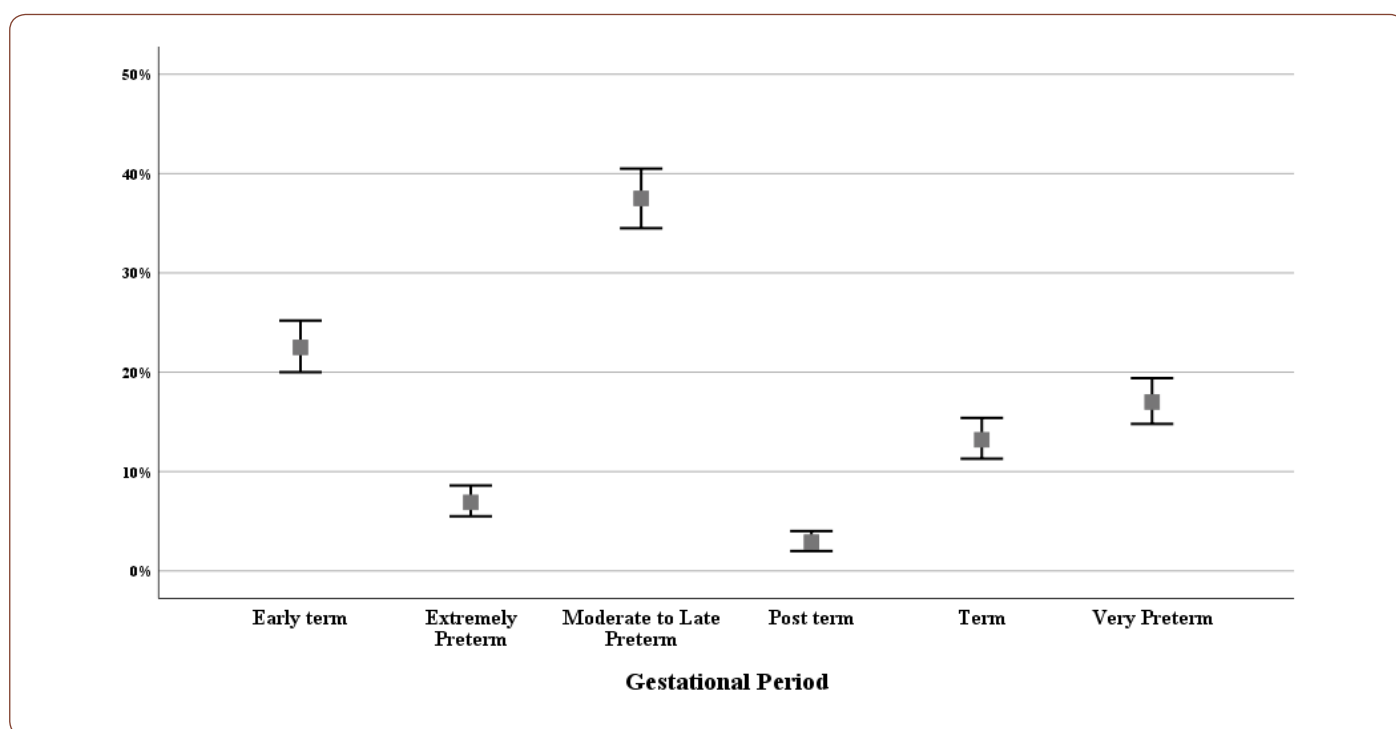
Characteristics	Frequency	Percentage
<b>Nationality</b>		
UAE resident	922	85.60%
Outside UAE resident	155	14.40%
<b>Parity</b>		
Primigravida	256	23.40%
Multigravida	825	76.60%
<b>Maternal Age</b>		
20-30 years	513	47.63%
31- 40 years	505	46.88%
41- 50 years	59	5.47%
<b>Mode of Delivery</b>		
Spontaneous vaginal delivery	456	42.30%
Lower segment C/S	621	57.70%
<b>Delivery Assistance</b>		
Forceps	7	0.60%
Vacuum	30	2.80%
Antenatal steroids in preterm pregnancies	383	35.60%

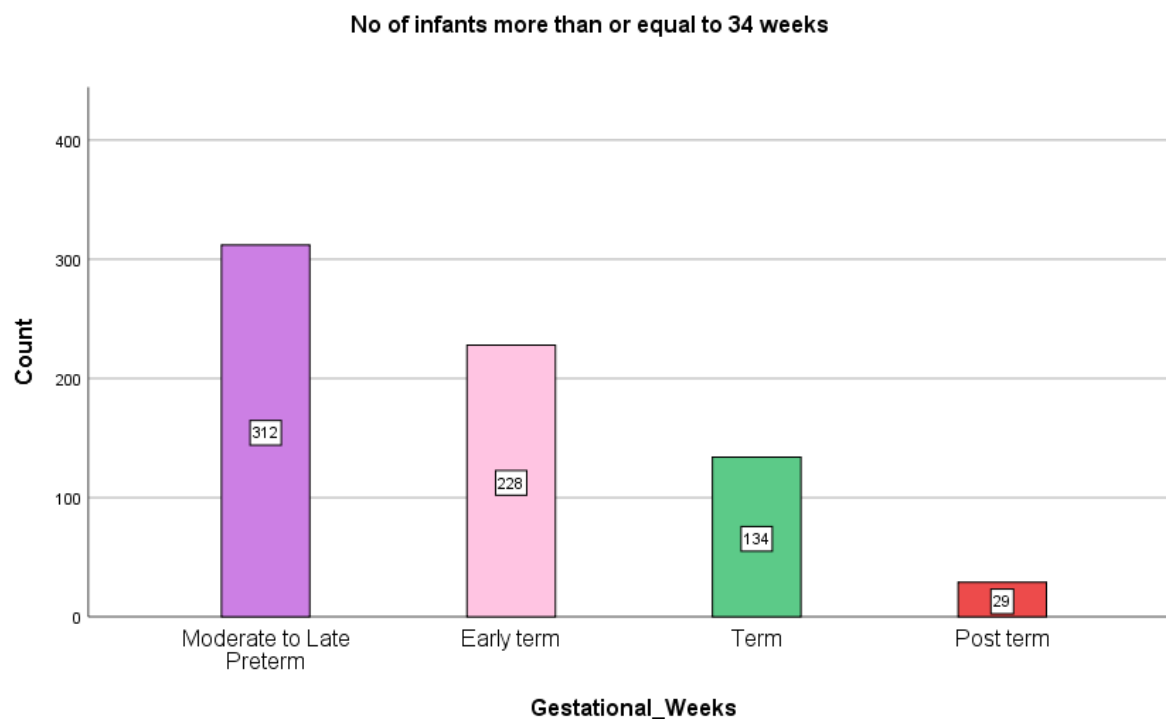
Among the admitted neonates, male babies were 56.8%, while rest were female, in which 141 babies had 1<sup>st</sup> minute APGAR lower than score 5. 483 of the total babies weighed more than 2.5 kg while 76 of the total babies had birth weight less than 1 kg. Out of 1077

patients, 39.64% were >37 weeks of gestation, while 64.06% were less than 36 weeks. Only 14.4% required ventilation after initial oxygen support following delivery (Figure 1&2), (Table 2).

**Table 2:** Characteristics of neonates admitted to NICU: (n=1077).

	Frequency [n]	Percentage [%]
<b>Gender</b>		
Male	612	56.80%
Female	465	43.20%
1 min APGAR less than 5	141	13.10%
<b>Birth Weight</b>		
> 4 kg	27	2.50%
3.5 to 3.99 kg	73	6.80%
2.5 to 3.499 kg	383	35.60%
2 to 2.499 kg	210	19.50%
1.5 to 1.99 kg	199	18.50%
1 to 1.499 kg	109	10.10%
<1 kg	76	7.10%
<b>Gestational Age</b>		
22-28	108	10.02%
29-32	166	15.41%
33-36	416	38.62%
>37	387	39.64%
<b>Support at Birth</b>		
Initial steps	154	14.30%
Initial oxygen support after Initial steps	395	36.70%
Ventilation after initial oxygen support	155	14.40%





**Figure 1:** Percentage of admissions to our two tertiary NICUs as per gestational ages is as shown above.

Regarding the primary diagnoses, out of a total of 1077 babies, 690 were admitted as case of prematurity, 237 term babies with different illness, 115 with different congenital anomalies, and 35 with proven infectious diseases. Figure 1 and table 3 below shows

**Table 3:** Secondary diagnosis of patients admitted to NICU (n=1077).

Primary Diagnosis	Secondary Diagnosis	f(%)
Prematurity	Early Term [37-38 weeks]	84
	Late preterm [35 weeks to 36 weeks]	160
	Preterm [33- up to 34 weeks]	203
	Very preterm [28 to 32 weeks]	170
	Extreme preterm less than or equal to 27 weeks	73
Infection diagnosed	Early onset sepsis	4
	late onset sepsis	1
	clinical sepsis	30
Congenital	CDH	4
	omphalocele	3
	gastroschisis	
	critical congenital heart disease screen	13
	genetic abnormalities	46
	miscellaneous	49
Term Babies	TTN	81
	jaundice	41
	hypoglycemia	22
	suspected sepsis	67
	HIE	12
	miscellaneous	14

**Table 4:** Stratification of maternal and neonatal characteristics with primary diagnosis (n=1077).

	Prematurity	Infection	Congenital	Term Babies
<b>Nationality</b>				
UAE resident	602	31	77	212
Outside UAE resident	88	4	38	25
<b>Parity</b>				
Primigravida	166	4	28	54
Multigravida	524	31	87	183
<b>Maternal Age</b>				
20-30 years	306	17	69	121
31- 40 years	343	17	40	105
41- 50 years	41	1	6	11
<b>Mode of Delivery</b>				
Spontaneous vaginal delivery	215	26	74	141
Lower segment C/S	475	9	41	96
<b>Delivery Assistance</b>				
Forceps	4	0	0	3
Vacuum	12	2	4	12
<b>Gender</b>				
Male	407	19	56	130
Female	283	16	59	107
<b>Birth Weight</b>				
> 4 kg	8	4	2	13
3.5 to 3.99 kg	11	8	7	47
3 to 3.499 kg	35	10	37	100
2.5 to 2.99	99	10	39	53
2 to 2.499 kg	174	1	15	20
1.5 to 1.99 kg	184	1	10	4
1 to 1.499 kg	104	1	4	0
<1 kg	75	0	1	0
<b>Gestational Age</b>				
22-28	96	0	2	0
29-32	148	2	6	0
33-36	446	1	23	0
>37	0	32	84	237
<b>Support at Birth</b>				
Initial steps	100	3	14	37
Initial oxygen support after Initial steps	287	11	30	67
Ventilation after initial oxygen support	123	3	21	8

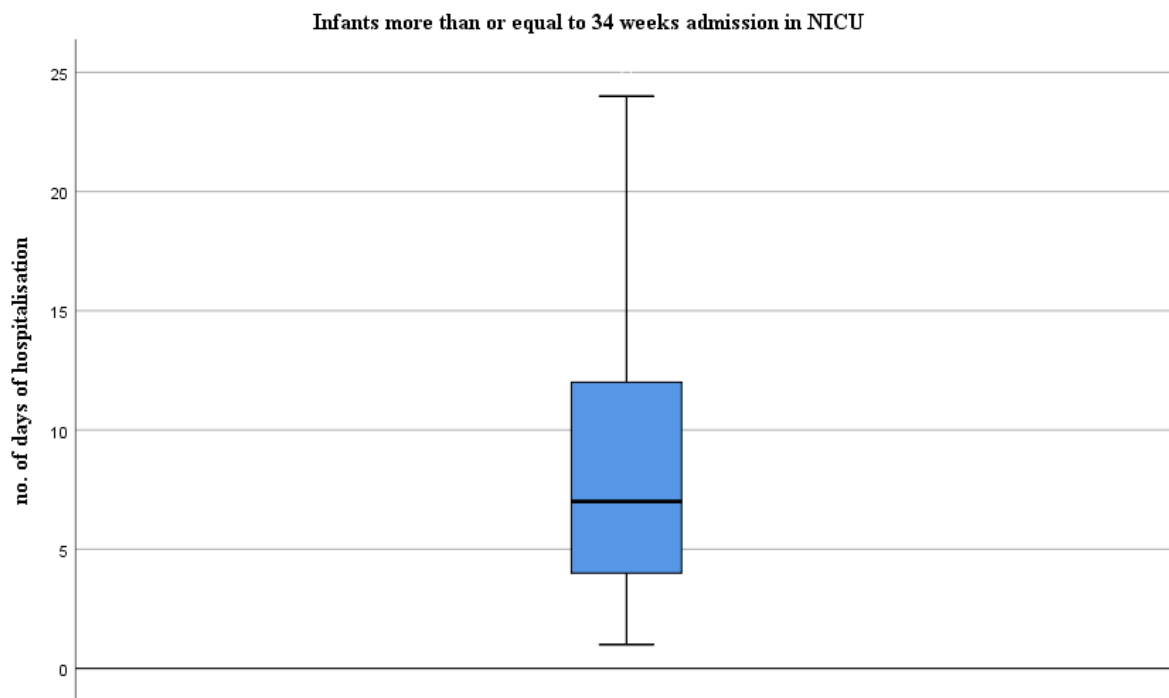


Figure 2: Number of days of hospitalization among infants more than or equal to 34 weeks.

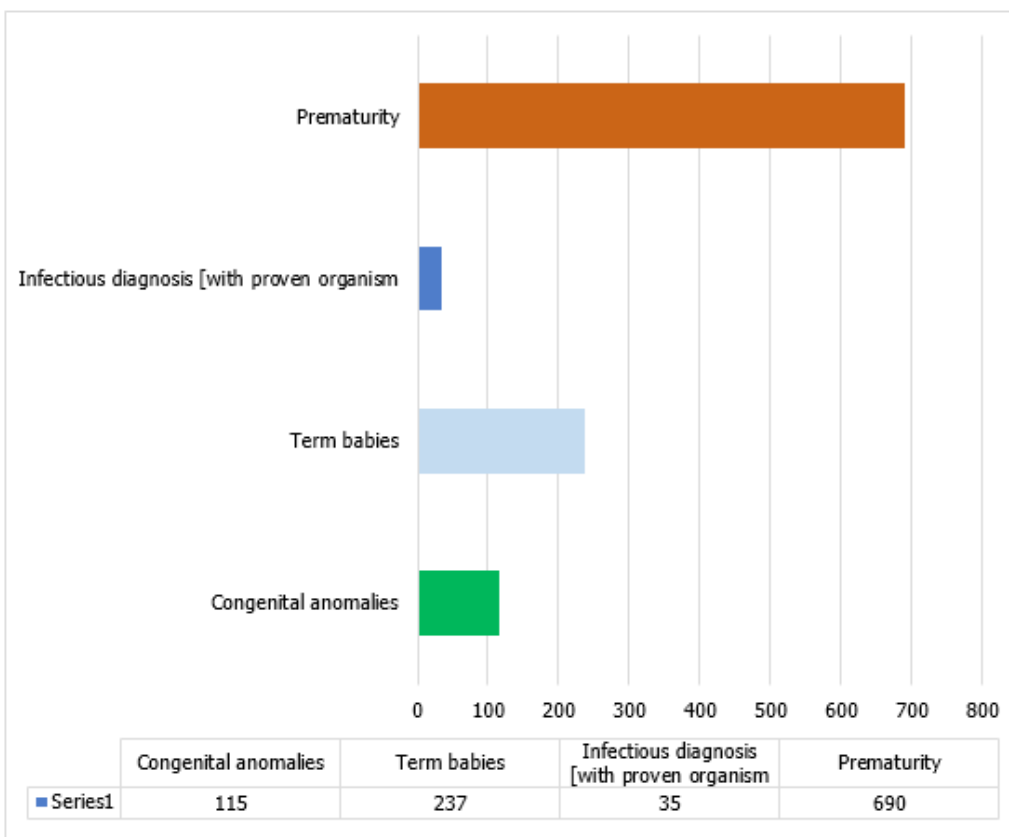


Figure 3: Showing primary diagnosis of the neonates admitted to NICU: (n=1077).

**Discussion**

Selective advancements in neonatal intensive care units (NICU) were made in the United Arab Emirates (UAE) which have consider-

ably increased survival ratio and decreased morbidity among newborn babies admitted to these NICUs. However, there are variations in utilization of NICU across tertiary care units in the UAE [6]. In

our cross sectional study from January 2017 to December 2019 all of the 1077 babies were admitted to 2 tertiary NICUs at Tawam hospital and at Al-Ain hospital respectively. 85.6% were Emiratis while 14.4% were non Emiratis. Among the admitted neonates 56.8% were male while rest of them were female. The demographic report of patients admitted to Canadian NICUs also disclose the predominance of male infants (57.5%) which is similar to the reports by NICHD (49% male) [7] and the Vermont-Oxford Trials Network (51% male) as well [8]. The main strength of this study is the use of large sample size and its representatives. We described the incidence and burden of neonates in these NICUs and associated risk factors. Majority 76.6% were multigravida, and 42.3% had spontaneous vaginal delivery. In our study, 74.5% were babies born at gestational age  $\geq 33$  weeks, which is almost similar to the 74% and 80% reported in the Canada and United States [9,10].

Admission of infants to NICUs brings certain risk factors [11] and increase acute stress for the neonate's families [12]. With our data regarding the primary diagnosis, 36% neonates carried various abnormalities. 3.2% of the total neonates were admitted with proven infectious diseases. The mean stay in NICU was 24 days in accordance with the previous studies [13,14]. 7% of all admitted neonates had a minimum single incidence of bacterial infection, which was confirmed by positive blood culture or urine culture or CSF culture. The incidence of infection was highest among infants with gestation age  $< 28$  weeks (30%) and low among infants with gestation ages between 33 to 37 weeks (3%) [15]. Despite the comparatively small variation in the neonatal characteristics, significant variations are observed in the follow up of infant groups homogenous for gestational age and merely moderate preterm [16]. We suggest that care units should monitor infant admissions by capacity, gestational age and related lengths of stay to better understand how features contribute to possible overuse in the confined context.

Length of stay at hospitalization in term and preterm neonates is greatly influenced by gestational age (GA) at birth and infant weight at the time of birth. The largest ratio of preterm babies admitted to NICUs are moderately preterm with comparatively minimum stays at hospitals. Variation in NICU utilization may have a huge effect on census of NICU and discharge period [17]. We limited our analysis to gestational age between 22-37 weeks which is pretty large as estimated in previous studies as well [17]. In our study 38.62% infants were born between 33-36 weeks while in contrast approximately 10% to 15% neonates born between 33-35 weeks 90 [18-35].

Our study concluded a significant variation in utilization of NICUs. A campaign to focus neonatal care takers on prudent use of NICU needs to be addressed. Regularization of monitoring follow up could have a momentous impact on minimizing the length of stay in term and preterm neonates [36-50].

## Conclusion

A campaign is needed in the UAE to help focus on the prudent

use of NICU so as to enable suitable use of tertiary level 3 NICU for really sick neonates. Efforts also need to be put in to create an observation area or transitional care area for babies who need minor help in transitioning at birth as well. Regularization of close follow up could have a momentous impact on minimizing the length of stay in term and preterm neonates.

## Acknowledgement

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## Conflict of Interest

No conflict of interest.

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