Introduction

Neonates truly constitute the foundation of human life. They have unique health issues and problems due to structural and functional immaturity of various body organs, depending upon their gestational age and birth weight. Newborn period is the most vulnerable phase of life. In India, deaths during first 28 days of life account for 70% of all infant deaths and 56% of all deaths of under-five children. It is worth to note that two-thirds of the newborns die in the first week of life and among them, two thirds die on day 1.[1] Despite a declining neonatal mortality rate globally, marked disparities in neonatal mortality exist across regions and countries. Regionally, neonatal mortality was highest in sub-Saharan Africa and South Asia, with the neonatal mortality rate estimated at 27 and 24 deaths per 1000 live births, respectively, in 2020. A child born in sub-Saharan Africa was 10 times more likely to die in the first month than a child born in a high-income country, while a child born in South Asia was nine times more likely to die. Across countries, the risk of dying in the first month of life was about 56 times higher in the highest mortality country than in the lowest mortality country.[2] India contributes to one-fifth of global live births and more than a quarter of neonatal deaths.
There has been a significant reduction in neonatal deaths in the last two decades in India. The annual burden of neonatal deaths reduced from 1.35 million in 1990 to 0.76 million in 2012. The neonatal mortality rate declined from 52 per 1000 live births in 1990 to 29 per 1000 live births in 2012, but the rate of decline has been slow and lags behind that of infant mortality rate.[8] In India, neonatal mortality was further reduced to 20 deaths per 1000 live births.[9] The neonatal deaths are associated with the quality of prenatal care, and quality care is influenced by access to health-care facilities and trained primary care physicians.[10] The main direct causes of neonatal deaths include preterm births (29%), severe infections (29%), birth asphyxia (23%), and congenital malformations (8%).[11] Low-birth-weight and premature babies are fragile and they require high degree of skills and technology for their intact survival. Many avoidable handicaps during childhood, such as cerebral palsy, mental subnormality, learning disabilities, and recurrent seizures, have their origin in the perinatal period.[12]

The National Health Mission (NMH) of India has invested heavily in the expansion of facility-based newborn care (FBNC). In India, 548 special newborn care units (SNCUs)[8] in district hospitals, 1810 newborn stabilization units (NBSUs) at community health centers, and newborn care corners (NBCCs)[8] have been created at every point of child birth. The strong component of the program is a systematic approach with close monitoring and evaluation to meet preset well-defined indicators.[13]

India needs to invest into research relevant to the needs of the country. The current status of neonatal research in India, which is far from satisfactory, lacks quality and utility for addressing the needs, according to a study by Gupta et al.[14] Therefore, systematic state-wide assessment of neonatal care is the need of the time. The FBNC is providing neonatal health-care services across the country to reduce the neonatal mortality rate. This study was conducted to assess the facilities with respect to the output indicators of Facility Based Newborn Care (FBNC) which has impact on neonatal health.

Aim and Objectives
To evaluate the essentiality and impact of FBNC at various levels of health-care system in terms of quantitative impact on improving neonatal health care in Maharashtra, India program. Permission from the institutional ethics committee was taken prior to the study.

Purposive multiphase multistage sampling method was utilized. The longitude and latitude of Maharashtra lie at 19.7515°N and 75.7139°E. In the first phase, the districts of Maharashtra were divided by longitudes and latitudes on the map. The grids were formed where the longitudes and latitudes met each other. In Maharashtra, out of total 36 districts, six districts were selected at the grids where the longitudes and latitudes intersected. The districts selected for the evaluation were Sindhudurg, Pune, Buldhana, Osmanabad, Nandurbar, and Gondia. In the second phase, among the talukas from each district, two talukas were selected at the grids formed where the longitudes and latitudes met each other near to the intersection of SNCUs. So, a total of six SNCUs at district hospitals and 12 NBSUs at rural hospitals/subdistrict hospitals were included in this study. Out of the selected districts, existing medical college hospital was also included.

The data was collected regarding the neonatal health-care service delivery provided at these facilities, admissions in these facilities, and outcome of the admitted babies over a period of 1 year. Percentages and descriptive methods were utilized for data analysis. Chi-square test was used for comparing the results among various groups.

Results
The FBNC program provides improved neonatal services in the existing facilities to reduce the neonatal mortality rate. The study was conducted to identify the admission pattern among the various health-care facilities and outcome of these admitted babies. The performance of the facilities was assessed with the help of the outcome indicators.

The male admissions were 55.5% and the female admissions were 44.5% in the SNCUs.

It is observed in Figure 1 that there were more outborn admissions in the SNCUs compared to inborn admissions, as SNCU is the higher center (district hospitals) under FBNC where referrals are done from lower centers (subdistrict/rural hospitals) for the management of complications.
The various reasons for admissions in the SNCUs were respiratory distress syndrome, birth asphyxia, meconium aspiration syndrome, hyperthermia, hypoglycemia, congenital malformations, and so on [Table 1]. The majority of admissions were for neonatal jaundice (16.7%), followed by birth asphyxia and respiratory distress syndrome (12.5%) in the assessed SNCUs.

Neonatal deaths were found to be higher in the babies having low birth weight, compared to those having normal birth weight [Table 2]. The risk of mortality was more among very low birth weight (VLBW) and extremely low-birth-weight babies of the admitted neonates. The difference was found to be statistically significant among the SNCUs.

Mortality was higher among the preterm babies compared to the term babies admitted in all SNCUs [Table 3]. The difference in various SNCUs was statistically significant among the term and preterm babies.

The mortality of neonates admitted in NBSUs was very less compared to that in higher facilities. The rate of referral varied from 12.9% to 52.5% among the different NBSUs in Maharashtra [Table 4].

Discussion

Neonatal outcome assessment in the FBNC program was carried out to observe the performance indicators of the neonatal health-care services provided at various facilities. A total of 18 facilities with six SNCUs and 12 NBSUs were included to delineate the outcome and factors leading to mortality of neonates.

Male admissions were more compared to female admissions in the assessed facilities. In a study carried out in Telangana by Mundlod et al.,[12] male admissions were more than female admissions. Comparable findings were found in some other studies with male preponderance.[13‑15] Such findings could be because of the biological vulnerability of male gender in our community. The outborn admissions outnumbered inborn admissions, as the SNCUs are located at higher centers where referrals from other facilities was common.

The risk of neonatal mortality was higher among low-birth-weight babies than normal weight babies, as they are at risk for many complications. These facilities help to provide timely services to the admitted babies. Primary care physicians play an important role in providing these facilities to improve neonatal health. Another important finding was that mortality was more in the preterm babies compared to the term babies.

In a study report published by Indian council of medical research (ICMR), sepsis (32.8%) is the major cause of neonatal mortality, followed by birth asphyxia (22.3%) and prematurity (16.8%),[16]

Table 1: Mortality profile of admitted neonates at the SNCUs

| Cause                                      | Nandurbar | Sindhudurg | Pune | Buldhana | Gondia | Total |
|--------------------------------------------|-----------|------------|------|----------|--------|-------|
| Respiratory distress syndrome              | 7         | 9          | 75   | 273      | 72     | 444   |
| Meconium aspiration syndrome               | 36        | 12         | 23   | 104      | 32     | 207   |
| HIE/mild-moderate-severe birth asphyxia    | 32        | 7          | 64   | 171      | 171    | 445   |
| Sepsis/pneumonia/meningitis                | 41        | 8          | 50   | 87       | 25     | 206   |
| Major congenital malformations             | 11        | 4          | 26   | 33       | 26     | 100   |
| Jaundice                                   | 65        | 58         | 90   | 137      | 245    | 595   |
| Hypothermia                                | 3         | 0          | 2    | 0        | 0      | 5     |
| Hypoglycemia                               | 0         | 1          | 16   | 3        | 3      | 23    |
| Other                                      | 159       | 91         | 364  | 427      | 553    | 1531  |
| Total                                      | 354       | 190        | 710  | 1235     | 1127   |       |

Table 2: Mortality in the SNCUs according to birth weight

| Birth weight (g) | Nandurbar | Sindhudurg | Pune | Buldhana | Osmanabad | Gondia |
|------------------|-----------|------------|------|----------|-----------|--------|
| 2500             | 111 (8)   | 61 (9)     | 266 (6) | 506 (6) | 583 (15) | 367 (21) |
| 1500-2499        | 174 (16)  | 108 (2)    | 310 (12) | 619 (14) | 489 (24) | 652 (35) |
| 1000-1499        | 61 (20)   | 18 (1)     | 104 (14) | 85 (19) | 64 (18)  | 89 (28)  |
| <1000            | 8 (6)     | 3 (1)      | 30 (11) | 25 (15) | 15 (10)  | 19 (6)   |

Table 3: Mortality in the SNCUs according to gestational age

| Gestation Unit | Nandurbar | Sindhudurg | Pune | Buldhana | Osmanabad | Gondia |
|----------------|-----------|------------|------|----------|-----------|--------|
| Term           | 150 (16)  | 96 (1)     | 346 (10) | 848 (13) | 658 (24) | 731 (43) |
| Preterm        | 204 (35)  | 94 (1)     | 364 (33) | 387 (51) | 493 (43) | 396 (44) |
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whereas in our study, the major cause for admission to SNCUs was neonatal jaundice (16.7%), followed by respiratory distress syndrome and birth asphyxia (12.5%). In a study carried out in Telangana by Mundlod et al.,[12] the most common causes of mortality were birth asphyxia (36.1%), respiratory distress syndrome (RDS) (27.7%), prematurity (21.9%), and neonatal sepsis (7.7%). The major cause of admission was respiratory distress syndrome (22%) along with infection (21%) in a study carried out in Gujarat by Shah SD et al.[13] The other reasons were jaundice (17%), meconium aspiration syndrome (14%), perinatal asphyxia as moderate or severe birth asphyxia/hypoxic–ischemic encephalopathy (12%), and other causes of respiratory distress (6%) that involve transient tachypnea, congenital pneumonia, and aspiration pneumonia. Morbidity due to congenital malformation, hypoglycemia, and hypothermia was less (3%).

Among the admissions in NBSUs, a large proportion, that is, 39.5%, of babies had birth weight <2500 g in the present study. The mortality was less in these facilities, as the high-risk babies and those with complications were referred to the higher centers for necessary management. The rate of referral varied from 12.9% to 52.5% among the different NBSUs in Maharashtra. In a study carried out in Bihar by Chauhan et al.,[14] there was a contrary finding that only 1.7% of babies were referred to the higher centers.

### Conclusion

The facilities were developed to provide improved and timely services to the neonates at the earliest. As neonatal mortality was found to be higher among the preterm and low-birth-weight babies, focus on the high-risk babies needs to be strengthened. The concept of “golden hour” is a new evolving strategy for better outcome of neonates; the immediate newborn care services provided at these facilities will add to the positive outcome of neonatal health.

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