Research Article

Assessment of the Performance of selected Special Care Newborn Units (SCANUs) in Bangladesh: A cross Sectional Study

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Abstract

Background: *Government of Bangladesh initiated the Special Care Newborn Units (SCANU) in 2011 at selected district hospitals followed by its scale up in other districts with support from UNICEF and other partners. The objective of the study was to assess the performance of those SCANUs in Bangladesh.*

Methods: *A cross-sectional study approach was applied for assessment of the performance of SCANU facilities compared to facilities without SCANU. Fifteen facilities with SCANUs and five facilities without SCANUs were selected from eight divisions of the country for the study. The selected SCANU and Non-SCANU facilities were of secondary level hospital with similar patient flow and workload. Quantitative data were collected from direct observation of the 20 facilities and interviews with 678 caregivers using a field-tested questionnaire. Caregivers were mothers of the infants (<59 days old) who were admitted and stayed for at least one day in those hospitals. Analysis was done using Stata version 15.1 and presented in tabular, graphical and numerical measures of central tendency and dispersion.*

Result: *The results of the assessment found that 60% of SCANU facilities had KMC care services and 27% of SCANU facilities had rooming in services and special sick baby ward services but no such services was available in non-SCANU facilities. Equipment in the SCANUs such as resuscitation bag and mask, radiant warmers, phototherapy machines and to a large extent CPAP machines and Oxygen blenders were mostly available and functioning optimally. More than half of the SCANUs still need to have oxygen blenders, CPAP machines and transcutaneous bilirubinometers since they were not found/functional during the assessment. Majority of SCANU facilities 60%-80% reported no stock-outs of critical medications like dexamethasone, ceftriaxone and gentamicin which are critical for management of preterm and sick babies. A web-based online 'Individual Case Tracking' system has been developed for online reporting from all SCANUs by the Health Management Information System (HMIS) of the Directorate General of Health Services (DGHS). UNICEF was supporting its linkage to the district health information system (DHIS-2). There was a statistically significant difference between SCANUs and non-SCANUs with respect to the proportions of admissions. SCANUs are acting as referral destination for sick and small newborns as 41%-45% of the admitted newborns were either were born at home or in other facilities.*

Conclusion: *The assessment findings will be helpful for country strategy for improving newborn care through expansion of SCANU expansion throughout the country.*

Trial Registration: Not applicable in this study.

Keywords: Assessment, Performance, SCANUs, Bangladesh, Cross Sectional Study

List of Abbreviations

CIPRB: Centre for Injury Prevention and Research, Bangladesh; CPAP: Continuous Positive Airway Pressure; DGHS: Directorate General of Health Services; DHIS-2: District Health Information System; DH: District Hospital; ENC: Essential Newborn Care; GoB: Government of Bangladesh; HMIS: Health Management Information System; HPNSP: Health Population and Nutrition Sector Program; HRH: Human Resources for Health; KMC: Kangaroo Mother Care; MoHFW: Ministry of Health and Family Welfare; MCH: Medical College Hospitals; MCWCs: Mothers and

Children Welfare Centre; NGO: Non-Government Organization; NMR: Neonatal Mortality Rate; NSU : Neonatal Stabilization Unit; QI: Quality Improvement; QA: Quality Assurance; RCH: Reproductive and Child Health, RRT: Regional Roaming Team; SOPs: Standard Operating Procedures; SCANUs: Special Care Newborn Units; UHCs: Upazila Health Complexes; U5MR: Under-5 Child Mortality; UNICEF: United Nations Children Fund.

Background

Bangladesh has made significant progress in reducing under-5 child mortality (U5MR) within the last two decades but newborn deaths have not seen commensurate progress [1]. Fifty percent of newborns deaths occur within first 24 hours after birth and mostly at home [2]. The country's U5MR reduced by over 77% from 149 to 34 per 1,000 live births between 1990 and 2016 [3,4]. NMR therefore contributes approximately 60% of U5MR currently and NMR also holds the key to achieving the UN Sustainable Development Goal targets for child mortality reduction [3]. To accelerate the reduction in neonatal mortality, SCANU have been started since 2011 at few selected hospitals [1].

These SCANUs have been scaled up by the government of Bangladesh (GoB) with support from UNICEF and other partners[5]. UNICEF has also provided technical assistance to develop standard operating procedures (SOPs) including the generic layout design and implementation guidelines for SCANUs which have been endorsed by the Bangladesh Ministry of Health and Family Welfare (MoHFW) [6]. UNICEF also leveraged its financial and technical support to the MoHFW to adopt a national scale-up plan for both community- and facility-based newborn care in health sector programme (HPNSDP, 2012-2016) [1]. The vision of the HNPSDP 2016-2022 is to ensure that the people of Bangladesh are healthier, happier and economically productive, and to make the country an upper middle-income country by 2021[7,8]. Under the programme, a new National Child Health Strategy is also being developed and the DGHS has introduced the open-access dashboard on DHIS2 platform to present real-time health data [9].

The Operational Plan for Maternal, Neonatal, Child and Adolescent Health has incorporated newborn health as one of the priority components [10]. With over half a decade of SCANU services and UNICEF's support for these, a formal performance assessment is essential to inform about successes in the approach and guide policymakers regarding the best practices and bottlenecks for further scaling up of SCANUs at a nationwide level [10]. The performance assessment will further elicit challenges and bottlenecks and guide the search for appropriate corrective actions to mitigate these in functioning SCANU with the overall aim to improve the quality of services for newborn care in Bangladesh [11].

Intrapartum-related complications including asphyxia, infections and complications of prematurity are responsible for about 80% of newborn deaths [12,13]. Over 52.5% of babies are born at home

[14] often without skilled attendants and when complications occur, they do not receive adequate care and therefore die [15]. In 2014, only 14% of deliveries took place in public and NGO (4%) facilities, and 29 % in private facilities [14]. At home, families cannot provide evidence-based essential newborn care (ENC) to these babies [16]. They are not able to identify danger signs in newborns or when they do, encounter several barriers in seeking and receiving care for their babies [17]. Appropriate and timely clinical care for small and sick newborns is estimated to reduce newborn deaths by 37% [18]. To seek appropriate care for these newborns families must be assured of quality in these facilities. The challenge is that, facilities to provide care of the requisite quality to save small and sick newborns are lacking at all levels-from community clinics to medical college hospitals. Also, it is documented that wide inequities exist in access to health services between rural and urban dwellers; the rich and poor; and between plain land residents and tribal populations [19-21]. The objectives of this assessment are to assess the performance of UNICEF-supported SCANUs, to understand how SCANUs currently operate and how they integrate with newborn care services at other levels of the health care system and maternity units in hospitals.

Methods

This cross-sectional assessment adopted a quasi-experimental design comparing newborn care services, practices of caregivers and quality of care in terms of inputs, outputs and outcomes between facilities that have SCANU services and those that do not. It involved review of records, observation of care, assessment of care infrastructure, amenities, equipment, drugs, supplies as well as quantitative interviews with clients.

The assessment was conducted in all eight divisions in selected Medical College and District hospitals, with and without SCANUs and in UHCs and MCWCs that refer mothers and their newborn to these hospitals. In each division, one district was selected in the district, one district hospital (DH) that had a SCANU that has been operational for at least two years was purposively selected. In addition, five Medical College Hospitals (MCH) with SCANUs were selected. Five additional hospitals, three DHs and two MCHs that did not have SCANUs were also selected to serve for comparison. Respondents for the assessment interviews and questionnaires were selected to represent a broad range of views on the performance of the SCANUs.

Facilities were stratified by type (medical college or district hospitals), by the organisations that provided support for the establishment, and whether they provided SCANU services or not. UNICEF Bangladesh provided a list of selected facilities based on workload, location (at least one district hospital per division and at least three medical college hospitals) and other parameters. The activities of assessment included recruitment and training of data collectors, the actual data collection, processing of data, data analysis and drafting of the report of the assessment.

Data collection tools were developed for the performance

assessment in close partnership with the UNICEF-Bangladesh team, the MoHFW and other key stakeholders. Adapted versions of the Multi-Country Situation Analysis tools were used for the quantitative data collection. The qualitative data collection tools included Key informant interviews, interviews with health facility staff SCANUs, including some QI/QA team members and managers, exit interviews with caregivers and key informant interviews with regional roaming team members. Data collection methods were selected according to the objective of the assessment (Table 1).

Research Objectives	Methods
1. To assess the performance of SCANUs	Facility observation
2. To understand how they operate	- Quantitative facility assessment (provider survey, checklist and observations) and review of training for SCANU staff - Exit interviews with caregivers (most likely mothers) of infants receiving care in a SCANU (3–5 per facility; 18-30 in total) and those not receiving care in a SCANU (3–5/facility = 9–15)

Table 1: Data collection methods according to research objective.

Data for the assessment were obtained through a review of records, quantitative interviews with facility providers, 20 observation of care within facilities, With these, the assessment strategy therefore covered current and previous practices within the facilities and 678 exit interview with the clients discharged from the hospitals (Table 2).

Study Types	Type of Participants	Level	Interview Conducted
Quantitative questionnaires	Care/Service providers within hospitals	All facilities	20 Observations
	Clients discharged from hospitals	All facilities	678 questionnaires

Table 2: Participants from whom data were collected for the qualitative and quantitative components of the assessment.

Data collectors received a 4½ days training on data collection. Tools were pretested before conducting quantitative study. Data collection for the assessment was conducted by teams of data collectors deployed across the divisions- one team per division. Each team comprised a clinician, and two research assistants. The clinician led all the clinical aspects of the data collection such as the observation of care and the administration of the clinical vignettes. The primary responsibility of the research assistants was to administer questionnaires for the quantitative survey.

The data analyses adopted an equity and rights-based approach to explore the coverage, access, and quality of processes, outputs and outcomes of the services provided within the health facilities. Quantitative data were analysed using Stata 15.1 and SPSS v.24. Descriptive statistics were generated to describe the data. These included rates of admissions, morbidity profiles of newborns admitted, and case fatality rates.

Results
The findings of the assessment are based on 20 facility observation and 678 quantitative questionnaires.
Current situation of the SCANUs in terms of facility's overall system, service condition, workforce, competency etc.
According to the report most of the facilities were found to be capable of providing care to sick newborn. But the overall performance of the SCANUs were found better regarding providing services to the newborn. In spite of the limited time of implementation the overall outcome of the newborn services was found better in facilities having SCANU in comparison to the facilities having no SCANU. SCANUs provide additional services like Kangaroo Mother Care (KMC), rooming- in where the sick new born is kept with its mother in the same bed. Besides, in SCANUs it also provides special sick baby ward (Table 3).

Service	SCANUs (n=15)	Non-SCANUs (n=5)
KMC	9/15 (60%)	0/5
Rooming-in service	4/15 (27%)	0/5
Special sick baby ward	4/15 (27%)	0/5

Table 3: Range of key additional services in the assessed hospitals and their distribution between SCANU & non-SCANUs from the assessment findings.

Availability of Human Resources

Scarcity of workforce was found one of the most common obstacles for both SCANU and non SCANU facilities. In most of the facilities it was found that nurses play the main role in patient management as a result the quality of health care in these facilities are being compromised. It is true that Human Resources for Health (HRH) is insufficient in both SCANU and Non SCANU facilities but, there are more sanctioned staff positions are filled in SCANUs than the non SACNUs. SCANUs have higher percentage of doctors including specialist, nurse (Figure 1).

Working Environment

Staff shortage exists during work shifts both in SCANU and non SCANU facilities. As a result, staffs move from one unit to another unit for providing services. But staffs in SCANU facilities comparatively do less movement than the non SCANU staffs. According to the report 33% staffs in SCANU facilities move from one unit to another work during work shift whereas in case of non SCANU staffs this percentage is 60%.

Availability of Medicines, Equipment and other Logistics

SCANU facilities have more critical equipment and medicine than the non SCANUs for the management of newborns. Again most of the facilities also complained about the breakdown of essential equipment. Scarcity of essential medicine was found in all facilities but in non SCANU facilities the situation is worse where 85% non SCANUs have crisis of essential medicine in comparison to 77% SCANUs (Table 4, Figue-2,3).

Key Equipment	15 SCANU Facilities								5 Non-SCANU Facilities					
	Total (n=15)		DH (n=8)		MCH (n=5)		UCH (n=2)		Total (n=5)		DH (n=3)		MCH (n=2)	
	S	R	S	R	S	R	S	R	S	R	S	R	S	R
Radiant warmer	13	2	6	2	5	0	2	0	3	2	1	2	2	0
Phototherapy lamps	14	1	7	1	5	0	2	0	4	1	3	0	1	1
Glucometer	12	2	6	1	4	1	2	0	2	3	0	3	2	0
Trans-cut. bilirubin test	4	11	1	7	2	3	1	1	0	5	0	3	0	2
CPAP	7	7	1	6	4	1	2	0	0	4	0	3	0	1
Pulse oximeter	11	2	4	2	5	0	2	0	1	4	0	3	1	1
Air/oxygen blender	3	8	1	5	1	3	1	0	1	4	0	3	1	1
Newborn bag & mask (0)	15	0	8	0	5	0	2	0	4	0	2	0	2	0
Newborn bag & mask (1)	12	0	6	0	5	0	1	0	3	1	1	1	2	0
Ventilator	5	10	1	7	2	3	2	0	1	4	0	3	1	1

S: Seen; R: Reported, not seen.

Table 4: Availability of functional critical equipment, medicines for newborn care in hospitals assessed on the day of assessment.

Clinical Care for Newborns

SCANUs are performing better regarding providing special care to newborn. This is why the percentage of getting admission of the newborn in SCANUs with complications like low birth weight, breathing problem, jaundice etc. are higher than the non SCANUs (Figure 4,5, Table 5).

Reason for admission to hospital	Category	15 SCANU facilities			5 non-SCANU facilities	
		District H (N=267)	MCH (N=212)	UCH (N=49)	District H (N=50)	MCH (N=100)
Causes of admission	Premature	24 (9.0%)	34 (16.0%)	4 (8.2%)	3 (6.0%)	6 (6.0%)
	Low birth weight	9 (3.4%)	26 (12.3%)	9 (18.4%)	1 (2.0%)	4 (4.0%)
	Birth injury	21 (7.9%)	24 (11.3%)	4 (8.2%)	6 (12.0%)	6 (6.0%)
	Breathing problem	61 (22.9%)	48 (22.6%)	24 (49.0%)	13 (26.0%)	21 (21.0%)
Mothers' account of babies' symptoms at admission	Umbilical infection	3 (1.1%)	1 (0.5%)	3 (6.1%)	1 (2.0%)	0 (0.0%)
	Breathing difficulty	97 (36.3%)	71 (33.5%)	17 (34.7%)	15 (30.0%)	43 (43%)
	Jaundice	40 (15.0%)	46 (21.7%)	12 (24.5%)	5 (10.0%)	11 (11.0%)
	Feeding problem	29 (10.9%)	23 (10.9%)	3 (6.1%)	3 (6.0%)	10 (10.0%)
	Fever	35 (13.1%)	15 (7.1%)	1 (2.0%)	5 (10.0%)	5 (5.0%)
	Hypothermia	7 (2.6%)	5 (2.4%)	5 (10.2%)	1 (2.0%)	0 (0.0%)
	Convulsion	15 (5.6%)	34 (16.0%)	4 (8.2%)	0 (0.0%)	12 (12.0%)

Table 5: Distribution of reasons for admission of newborn in SCANU and non-SCANU facilities.

Connections with Facilities for Referral

According to the findings of the assessment, approximately 41% to 45% of all babies in the neonatal care units were referred from other facilities. The biggest proportion of referrals (53%) came from UCHs, whereas the lowest came from DH with SCANUs (37%). The majority of these referrals came from outside the immediate lower-tier health facility (UHC, MCWC or NSU). Because districts lacking SCANUs are less likely to have NSUs, it's not unexpected that they didn't get any referrals from them. The poor referral rate from NSUs even in SCANU facilities is a reflection of weak communication among the various health facilities. Low utilization of NSUs as families by pass them along with referral routes and straight go to the SCANUs or poor referral practices of NSUs could be reason of poor referral rate from NSUs. While bypassing NSUs may save unnecessarily long wait times for newborns, it may also compromise triaging and cause overcrowding within SCANUs, lowering the quality of care. Not all SCANU areas, however, have associated NSUs. Health personnel were also the most likely to urge families to transport their newborns to SCANUs (43%), whether from the same hospital, another health facility, or at home, according to the study. While health personnel were the most likely to recommend SCANU care, families themselves were more likely to send their unwell newborns to non-SCANU facilities, and this difference in referral trends was statistically significant (p=0.001). Healthcare workers may be becoming more aware of SCANUs' importance in infant care and, as a result, promoting for their usage by families in areas where they are available. Unavailability of transport was found one of the reasons for this existing poor referral system where only one fourth of the new born were taken to SCANUs with ambulance and the percentage of new born using ambulance to reach to non SCANUs is even lower (Table 6, Figure 6).

Referral	Category	15 SCANU facilities				5 non-SCANU facilities			p-value
		Total (N=528)	District H (N=267)	MCH (N=212)	UCH (N=49)	Total (N=150)	District H (N=50)	MCH (N=100)	
Referral source	MCWC	6 (2.8%)	2 (2.0%)	4 (4.4%)	0 (0.0%)	1 (1.5%)	1 (4.4%)	0 (0.0%)	-
	UHC	52 (24.1%)	27 (27.6%)	19 (20.6%)	6 (32.1%)	17 (25.0%)	2 (8.7%)	15 (33.3%)	-
	NSU	1 (0.5%)	1 (1.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	-
	Other	155 (71.8%)	68 (69.4%)	67 (72.8%)	20 (77.9%)	50 (73.5%)	20 (87.0%)	30 (66.7%)	
Who advised that infant is brought to hospital	Health worker	229 (43.4%)	109 (40.8%)	99 (46.7%)	21 (42.9%)	47 (31.3%)	15 (30.0%)	32 (32.0%)	0.001

	Family	188 (35.6%)	99 (37.1%)	77 (36.3%)	12 (24.5%)	75 (50.0%)	33 (66.0%)	42 (42.0%)	
	Other	111 (21.0%)	59 (22.1%)	36 (18.7%)	16 (32.6%)	28 (18.7%)	2 (4.0%)	26 (26.0%)	-
Number of different vehicles) taken to get to the facility	One	309 (58.5%)	153 (57.3%)	128 (60.4%)	28 (57.2%)	100 (66.7%)	38 (76.0%)	62 (60.0%)	0.29
	Two	31 (5.9%)	14 (5.2%)	16 (7.5%)	1 (2.0%)	9 (6.0%)	5 (10.0%)	4 (4.0%)	
	Three or more	19 (3.6%)	10 (3.8%)	8 (3.8%)	1 (2.0%)	1 (0.6%)	0 (0.0%)	1 (1.0%)	
	Not applicable	169 (32.0%)	90 (33.7%)	60 (28.3%)	19 (38.8%)	40 (26.7%)	7 (14.0%)	32 (32.0%)	
Used ambulance to get to facility (those with known transport means)		92 (25.6%)	23 (13.0%)	49 (32.2%)	20 (66.7%)	25 (22.7%)	0 (0.0%)	25 (36.8%)	0.54

Table 6: Referral and decision-making around care seeking for infants from caregiver interviews.

Mortality Audits to Improve Quality

Among SCANUs, 60% are routinely conducting mortality audits within the facilities. This is marginally higher than in non-SCANUs (50%). Though the numbers are small to draw conclusive evidence of differences, clearly, DHs with SCANUs perform poorer in the conduct of audits of adverse outcomes than non-SCANU DHs. At the MCH level, no audits are reported in non-SCANU facilities whereas 60% of those in SCANUs conduct these audits. There was also a difference between the SCANUs and non-SCANUs at the district level with respect to the staff used for conducting death audits. Whereas doctors, nurses/midwives, facility managers, pharmacists and laboratory staff were involved in audits within SCANU facilities, only the first two were involved in non-SCANUs audits. Ten facilities reported routine review of the management of newborns and young infants admitted for care. Only 2 (20%) could be verified. However, 38% of DH SCANUs reported this practice compared to 50% who review deaths and 25% who review "near misses". No non-SCANU facility audits reasons for admissions or "near misses".

Follow-up of Infants Discharged from SCANUs

There were no specific mechanisms and procedures in place to follow-up newborns discharged from SCANUs or other hospitals. . Less than 15% of women who were to be discharged from SCANUs and non-SCANUs were told how to take care of their babies at home, less than 10% knew what help might be available in the community for them and a similar proportion were told about danger signs in the newborn as at the time of discharge (Table 7).

Assessed Modality	15 SCANU facilities				5 Non-SCANU facilities		
	Total (N=528)	District H (N=287)	MCH (N=212)	UCH (N=49)	Total (N=150)	District H (N=50)	MCH (N=100)
Caregivers who reported that nurses or doctors talked with them about how to take care of their babies at home.	13.3%	16.1%	7.1%	24.5%	14.7%	10.0%	17.0%
Caregivers who reported that they were familiar with types of help that might be available when the baby goes home	9.7%	6.8%	10.4%	22.4%	15.3%	18.0%	14.0%
Caregivers who reported that facility staff talked with them about danger signs for which they should immediately come to clinic?	13.2%	5.7%	14.8%	46.9%	8.7%	16.0%	5.1%
Caregivers who reported that they felt comfortable that they will be able to provide the care their babies need at home	97.3%	97.0%	98.6%	93.8%	98.6%	97.9%	99.0%

Table 7: Referral and continuity of care from facility to community.

Care of Newborns within Maternity Labour Wards

Overall, care for newborns in the maternity wards of the facilities assessed was poor. Consistently all facilities had sphygmomanometers, weighing scale, oxygen cylinders and newborn Ambu bags but important equipment such as radiant warmers pinard stethoscope or oxygen concentrators were lacking. Although SCANUs were replete with equipment, their corresponding labour wards were almost not equipped for newborn care. Between DHs with or without SCANUs, there was a clear difference with most equipment not available in non-SCANU facilities. The absence of equipment was not the only indication of poor quality of care for newborns [Figure 7].

Discussion

The major findings of this assessment include the staff from SCANU facilities have had more training in the care of small and sick babies within the two years preceding the assessment than those from non-SCANUs. Critical equipment in the SCANUs such as resuscitation bag and mask, radiant warmers, phototherapy machines and to a large extent CPAP machines and Oxygen blenders were mostly available and functioning optimally. In places where SCANUs have been established, their primary target clientele (small and sick newborns) seems to be having access to care. In spite of the labour wards not being the primary focus for the establishment of the SCANUs, some facilities with SCANUs have seen improvements in the labour wards as part of ensuring continuity of care for newborns. The main barrier to accessing and receiving SCANU services for newborns was the perception of poor quality which was linked to non-availability of HRH at the some of the SCANUs and the poor attitudes of the existing HRH in the SCANUs.

SCANUs have been established in 49 hospitals across the country, with the implementation staggered according to need [22]. UNICEF is the single most important contributor, having supported the establishment of 35 functional units. Interventions at the SCANUs have led to acquisition and retention of human resources for care of newborns and young infants better than the non-SCANUs [23]. However, there are still gaps that can be improved to ensure comprehensive care with motivated and skilled staff since one-third (34%) of nursing positions within SCANUs are still vacant as is one-fifth (18%) of doctors'. The human resources for health (HRH) availability gaps at SCANUs seemed universal-same for DH, MCH or UHC [24].

Human resource development and capacity building is pivotal to sustaining such innovations in health. SCANUs are operating with very limited human resource and this may lead to overworked staff, poor quality of care, lower staff morale, poor accountability and systematic failures in achieving its mission [25]. Human resource requirements should be very early considerations and systems to motivate and incentivise staff using means other than money may be helpful. Clearly, due to the high quality expectations, when staff from SCANUs are rotated to other areas of care in the same facility, they thought it was a welcome escape from the heavy load in the SCANUs.

Data is key to evidence-based practices. The poor data collation and management system within the SCANUs requires re-look [26]. The online data monitoring system that is being rolled out should not aim to be solely reporting to the central government but to empower individual facilities to use the data for decision making and action [27]. The data must feed into quality improvement and quality assurance practices in SCANUs to make them useful.

A system of mentoring and supportive supervision as is being practiced by the RRTs for the SCANUs is pivotal to success [28]. However, the system is currently more centralised and has limited capacity to cover the country. Mechanisms to devolve the system of RRT support to SCANUs to districts will cut down the cost of these activities, improve the HRH capacity within districts and hence allow for shorter distance between mentors and mentees to improve effectiveness and increase frequency of contacts to reach the needed impacts [29]. Equipment maintenance in specialised units such as the SCANUs requires commensurate investment of human capital to maintain them. When such maintenance can be made routine and handled by skilled persons, it reduces the cost, prevents breakdown, assures quality in caregiving and reduces staff frustrations [29].

Improving the quality of care provided in the SCANUs will take time to bed in before translating into sustained reductions in mortality. In fact, when quality of care concurrently increases with quality of data capture, the likelihood is for mortality outcomes to increase initially partly because of better capture of adverse events and the increased referral of late-stage diseases for quality care that would have otherwise been kept at home [30]. It is only when facilities have evolved and have better response to late-stage diseases that the outcomes start to improve. This seemed to be the case for the SCANUs assessed especially in the DHs where special care for newborns and young infants is a novelty.

Moreover, facility performance, measured by outcomes of care, requires a balance between the inputs and the processes of care giving [31]. The structures and equipment within the SCANUs will not translate into mortality reductions unless it is coupled with adequate staff, well trained and regularly updated on evidence-based best practices; functional equipment; available medicines and supplies; accountability mechanisms that make staff responsible collectively for these outcomes without blaming; and staff have the right attitude towards clients. In many of these, although the SCANUs are several steps ahead of the facilities without SCANUs, there are big gaps that need to be improved.

Conclusion

The findings of this study will inform the future direction of the facility-based care for small and sick newborns and contribute to mechanisms to ensure effective implementation of related newborn care programmes in the country and similar settings around the world. The findings of this performance assessment of Bangladesh's UNICEF-Supported SCANUs will inform policy-makers and programme managers on key interventions needed within health facilities and communities to ensure newborns

survive and thrive to reach their maximum potentials. It will also inform the scale up of the SCANU programme and key ancillary services that need to go with the implementation. It will inform on how to effectively link the facility-based care with home-based interventions within the communities as well as provision of continuum of care around birth from the maternity unit to the SCANU. The findings will contribute to future programme and policy decisions and ensure accountability on expected results set out by MoHFW-UNICEF.

Declarations
Ethics approval and consent to participate.

This is to certify that no humans and/or the use of human tissue samples was used to conduct this study. All experiments were performed in accordance with relevant guidelines and regulations. The study was conducted after receiving the approval from the ethical review committee.

- All methods were carried out in accordance with relevant guidelines and regulations.
- All experimental protocols were approved by a named institutional and/or licensing committee.
- The informed consent was obtained from all subjects and/or their legal guardian.

Consent for Publication
Consent was taken from each of the respondents during data collection about utilization of data for publication.

Availability of Data and Materials
The data that support the findings of this study are available from UNICEF but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. Data are however available from the authors upon reasonable request and with permission of UNICEF.

Competing Interests
There is competing interests for this publication.

Authors' Contributions
Shamina Sharmin (SS)-Wrote the first draft of the manuscript.
Md Ziaul Matin (MZM)-Developed the study methods, Approved the final manuscript.
Minjoon Kim (MK)-Approved the final manuscript.
Abu Sadat Mohammad Sayem (ASMS)-Developing the research question and study methods, Contributed to the screening, Approved the final manuscript.
Fazlur Rahman (FR)-Developed the research question and study methods, Contributed meaningfully to the drafting and editing and approved the final manuscript.
Abu Sayeed Md. Abdullah (ASMA)-Drafting and review of the manuscript.
Sifat Parveen Sheikh (SPS)-Data extraction and analysis, Approved the final manuscript.
Abdul Halim (AH)-Conceived of the idea, Developed the research question and study methods, Wrote the paper, Analyzed the data.

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