Assessment of Basic Emergency Obstetric and Newborn Care Functionality of Rural Health Units in Luzon

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ABSTRACT

Background. Establishing and integrating Basic Emergency Obstetrics and Newborn Care (BEmONC)-capable facilities into the healthcare delivery system is one of the strategies employed by the Philippine government to address high maternal mortality.

Objectives. This study aimed to determine the functionality of BEmONC-capable rural health units (RHUs) in Luzon, the largest island in the country.

Methods. The study utilized a researcher-administered facility survey and facility observation using a checklist designed to measure BEmONC functionality. Facilities were selected through a two-stage sampling method. A BEmONC Score Card was used to determine the overall functionality of a facility based on three categories — institutional capacity, service capacity, and personnel capacity. The total scores from the three categories provided the overall functionality score.

Results. Of the 245 BEmONC-provider RHUs included in the study, 85 (35%) were adequately functional. The mean functionality score for Luzon (60±25.27) corresponded to adequate functionality. The mean institutional and service capacities were consistently high across all regions on the island. Still, the personnel capacity did not reach the minimum average, pulling down the overall score and leading to low overall functionality.

Conclusion. The BEmONC facilities continue to function despite being hampered by factors that can be easily remedied. The provision of BEmONC services remains relevant across all regions in Luzon as they fill in the gaps and serve the needs of mothers and pregnant women. This study should be replicated in the Visayas and Mindanao to obtain a complete representation of the BEmONC program.

Keywords: maternal, BEmONC, assessment, maternal mortality, functionality

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INTRODUCTION

In the Philippines, as in the rest of the world, maternal mortality is a problem that remains significant despite various interventions. According to the World Health Organization (WHO), globally, ten women die daily, primarily due to bleeding, infection, and unsafe abortions.[1] The Maternity Worldwide Organization reported that from 2000 to 2015, there was a worldwide decrease in maternal mortality from 543,000 to 287,000 after the Millennium Development Goals (MDG) were adopted in various countries and a 38% decline worldwide in Maternal Mortality Ratio (MMR) from the year 2000 to 2017.[2,3] Though there is progress among developing countries in terms of maternal healthcare, the rate of decline in maternal death is still less than half of the targets of MDG.[2]

In 2017, the Department of Health (DOH) reported 1,484 maternal deaths and a MMR of 90 deaths per 100,000 live births, with eclampsia and hypertension as the leading causes of death.[4] The Philippine Obstetrical and Gynecological Society (POGS) also listed the leading causes of maternal mortality as hypertension (28%), hemorrhage (27%), infections (6%), vascular accidents (2%), and other causes (8%).[3] In addition, maternal mortality is indirectly due to anemia, malaria, and heart diseases.[5]

To address maternal mortality, the DOH implemented different strategies in the last two decades to decrease the MMR to 70 per 100,000 live births and infant mortality rate (IMR) to 12 per 1000 live births by 2030, all following the country's commitments to the UN Sustainable Development Goal (SDG) 3.[6,7] The maternal, newborn, and child health and nutrition service delivery network aimed to bridge gaps in maternal health referral systems and improve coordination across healthcare levels. The network had three levels of care: (1) Community-level service providers; (2) Basic Emergency Obstetrics and Newborn Care (BEmONC)-capable network of facilities and providers; and (3) Comprehensive Emergency Obstetrics and Newborn Care (CEmONC)-capable facility or network of facilities.[8] This was anchored on EmONC, which decreased MMR in low- to middle-income countries by incorporating multiple interventions such as training, deployment of skilled professionals, facility upgrades, and provision of supplies and equipment.[9-12]

BEmONC offers basic obstetric and newborn care at the primary health care level to reduce maternal and newborn mortality, usually employed in low- and middle-income countries and rural areas without many health facilities. Key to the role of BEmONC facilities is the performance of signal functions, which are interventions that significantly mitigate maternal mortality and morbidity.[12] Examples of these signal functions include administration of drugs such as uterotonics and performing procedures like manual placenta extraction. As such, BEmONC facilities are expected to be open 24 hours per day, seven days per week.

Multiple studies have shown that early detection of high-risk pregnancy and referral to capable facilities can improve pregnancy and delivery outcomes, including neonatal death. In developing countries, neonatal asphyxia contributes to a third of neonatal death.[13-15]

To further improve maternal and neonatal services, facility mapping and needs assessments were performed nationwide to provide information on infrastructure, equipment, and human resources needs - this determined which locations warranted improvement to be at par with BEmONC standards. However, since its inception and implementation 11 years ago, there have been no assessments as regards the functionality, effectiveness, and impact of the EmONC-based strategy.

Effective maternal and neonatal health services delivery can be achieved by making necessary infrastructure and transportation facilities available and accessible - including basic needs such as but not limited to spaces, beds, equipment, uninterrupted power supply, and clean water source.[16,17] The referral system is vital in ensuring that emergency patients are quickly taken to the next higher level of health-care service.[16,18]

However, since the establishment of BEmONC facilities in the country, there has been no evaluation as to whether or not they fulfilled their intended roles and implemented the interventions and management they were supposed to provide. This functionality is crucial in determining their impact on improving health outcomes. This study aimed to assess the functionality of BEmONC-capable rural health units (RHUs) in Luzon, Philippines. Consisting of eight administrative regions and 81 provinces, Luzon is the biggest island in the archipelago and accounts for more than half of maternal deaths in the country.[19] Further, since the functionality is influenced by the presence of infrastructure, personnel, and actual provision of specific interventions, these were the critical areas measured as institutional capacity, service capacity, and personnel capacity for signal functions, respectively.

METHODS

Study Design and Population

The study utilized a researcher-administered facility survey and facility observation using a checklist designed to measure BEmONC functionality. Respondents of the facility survey were those directly involved in providing BEMONC services. Facilities were selected through a two-stage sampling method. Provinces in each region were stratified according to 2019 MMR[17] into three strata, and one province was purposively selected per stratum. In the second state, 10-11 facilities were systematically sampled from among all BEmONC RHUs in the province from a list provided by the Department of Health's Safe Motherhood Program.[20] Alternate facilities were also identified in case local quarantine restrictions precluded the inclusion of the selected facilities.

The sample size was computed using the WHO Monitoring Emergency Obstetric Care Handbook, recommending at least 30% of facilities in the target area.[20] Thus, the study targeted 244 of the 812 BEmONC RHUs in Luzon, which enabled the detection of ≥6% difference from 4% of BEMONC facilities able to perform all signal functions at 80% power and an alpha of 0.05.[21]

A desk review of selected maternal health indicators from the Field Health Service Information System (FHSIS) in the selected provinces was conducted to estimate trends in facility-based delivery (FBD), skilled birth attendance (SBA), and maternal and infant mortality before and after EmONC implementation. Provincial-level FHSIS data on these indicators for the years 2000 to 2018 was requested from the provincial health offices of the selected provinces. Extracted data for the three areas chosen in each region were encoded into an Excel spreadsheet and subjected to an interrupted time series analysis using Stata 14.2.

Data Collection Tools

A BEmONC Survey Toolkit consisting of a facility survey form and scorecard was developed using the Delphi method. The facility survey form was adapted from the Monitoring Emergency Obstetric Care Handbook.[20] It included questions and observations on available resources in the facilities, such as medications, equipment, infrastructure, and human resources. Service delivery data covering the period of December 2019 to November 2020 was extracted from facility registries.

The BEmONC Score Card was used to determine the overall functionality of a facility based on responses to the survey. The scorecard consisted of three categories: (1) institutional capacity (i.e., protocols, infrastructure capacity, medicine supply and storage, equipment, and basic utilities); (2) service capacity (i.e., number of BEmONC trained personnel, ante-, and post-natal care, family planning, deliveries, referrals, and maternal and neonatal deaths); and (3) personnel capacity to perform signal functions. Each category contained ten questions answerable by a Likert scale from 0 (none) to 3 (always), with 90 as the highest possible score.

The scores for each category were then added to yield the overall functionality score. To ensure balance among the categories, a facility should have a minimum score of 20 in all three categories to be considered "adequately functional."

Data Analysis

Functionality score distribution was described in means (± standard deviation) for normally distributed data or in median and IQR for non-normally distributed data. Overall functionality was defined as adequate (score of ≥60 with no score <20 in any category) and inadequate (score of <60 or a score <20 in any category). At the same time, differences between regions and MMR strata were measured using Chi-squared tests.

Secondary data were subjected to an Interrupted Time Series (ITS) analysis to determine if the target outcome indicators of the MNCHN framework for maternal health were achieved. The ITS was limited to analyzing data from surveyed provinces, with no comparison group. The counterfactual was the same provinces before the introduction of BEmONC.

Ethical Considerations

This study was also registered with the Philippine Health Research Registry (ID number PHRR201127-003171), and the Single Joint Research Ethics Board approved the research (registration code SJREB-2020-75). The Advancing Health funded this study through the Evidence-Assisted Decisions-Health Policy and Systems Research (AHEAD-HPSR) program of the DOH and PCHRD.

Data collection teams adhered to standard health protocols and local government unit requirements for incoming travelers.

RESULTS

Facility Survey

From the three provinces selected per region based on their MMR, each had 10-11 facilities assessed, yielding 30-32 facilities per region. A total of 245 out of 812 BEmONC provider RHUs in Luzon were included in the final analysis. The facility survey was conducted from January to April 2021.

Institutional Capacity

The availability of infrastructure, equipment, utilities, policies, and transport for referral systems comprise institutional capacity. The RHUs across Luzon had an average of three beds in each facility, with Region 3 having the least (two beds each) and Region 1 having the most. On average, there were two delivery tables per RHU in Luzon.

Almost all facilities (>90%) had electricity from the power lines and piped-in water supply. Facilities without electricity were all not functioning as BEmONC facilities and were located in NCR. Three-fourths of the facilities had a water supply in their examination rooms, delivery rooms, and maternity ward. In contrast, ≥90% had available water supply for ante-natal, post-natal, and family planning services. Most facilities (82.8%) had a constant water supply for the past month, but only half had water for cervical cancer screening (50%).

Institutional capacity scores differed considerably among regions. The mean institutional capacity score for Luzon was adequate (23.4±8.8). Region 1 had the highest mean score, while NCR had the lowest. Approximately three-fourths of the facilities (73.5%) had sufficient institutional capacity, with Region I having the highest and NCR having the lowest (Table 1).

Table 1. The proportion of BEmONC RHUs in Luzon with Adequate Institutional, Service, and Personnel Capacity by region, 2021

Region	Facilities with Adequate Institutional Capacity (n, %)	Facilities with Adequate Service Capacity (n, %)	Facilities with Adequate Personnel Capacity for Signal Functions (n, %)
NCR	14 (46.7%)	14 (46.7%)	9 (30.0%)
CAR	27 (87.1%)	26 (83.9%)	1 (3.2%)
Region 1	29 (96.7%)	29 (96.7%)	29 (96.7%)
Region 2	24 (77.4%)	29 (93.6%)	4 (12.9%)
Region 3	21 (70.0%)	19 (63.3%)	7 (23.3%)
Region 4A	23 (76.7%)	24 (80.0%)	18 (60.0%)
Region 4B	20 (62.5%)	23 (71.9%)	8 (25.0%)
Region 5	22 (71.0%)	20 (64.5%)	9 (29.0%)
Total	**180 (73.5%)**	**184 (75.1%)**	**85 (34.7%)**
Chi-squared test p values	**p = 0.001**	**p < 0.001**	**p < 0.001**

MMR stratum was not significantly associated with institutional, service, or personnel capacity adequacy (Appendix 1).

Service Capacity

Most of Luzon's surveyed facilities (73.5%) had only one BEmONC-trained physician. Only a small number of RHUs (7.35%), mainly in Region 4B, had at least one deployed physician from the Doctors to the Barrios Program. Similarly, 70.6% of RHUs had at least one BEmONC-trained nurse, with CAR and Region 1 having one facility each with ≥5 BEmONC-trained nurses. Almost all of the facilities without any BEmONC-trained nurses were in NCR. Most facilities (60.4%) had at least one deployed nurse from the Nurse Deployment Program. Almost all facilities (91.0%) had at least one to five BEmONC-trained midwives. Only 40.8% of the facilities, most of which were in Region 5, had a deployed midwife from the Rural Health Midwife Placement Program. More than half of those without a BEmONC-trained doctor, nurse, or midwife was in NCR.

Most referrals were maternal cases (74.4%) and neonatal cases (44.46%). The leading causes for referrals were pre-eclampsia (30.3%), prolonged obstructed labor (21.6%), and hemorrhage (5.5%) for mothers. In comparison, the leading causes of neonatal referrals were respiratory difficulties (21.2%), prematurity (14.9%), low birth weight (6.3%), and sepsis (6.3%).

Almost all of the study facilities (92.8%) performed patient transfers, and most had staff accompaniment by midwives (93.6%), community health workers (88%), and other health workers available (98.8%). Monthly or quarterly reports were done in 74% of the facilities. Of the BEmONC RHUs, 80.3% were able to contact the referral hospital before the patient transfer, but only 46.1% of RHUs reported receiving feedback for their referrals to higher-level facilities.

All facilities' mean service capacity score was adequate (22.8±8.8), with CAR having the highest and NCR having the lowest. (Figure 1) Based on service capacity scores, 75% of RHUs had adequate service capacity as BEmONC providers. Region I had the highest, and NCR had the lowest proportion of facilities with sufficient service capacity. There was a significant association between region and service capacity. (Table 1)

Personnel Capacity for Signal Functions

The nine signal functions considered in this study are listed in Table 2. The signal function most commonly reported in the past 6-12 months is a referral to CEmONC, followed by partograph review and administration of uterotonic drugs. Less than half of the facilities surveyed reported performing newborn resuscitation, parenteral administration of uterotonics, antibiotics, and antenatal corticosteroids during the past year since there was no indication for these among the patients delivering at their facilities.

Only one-third of the surveyed facilities (34.7%) had adequate personnel capacity to perform the signal functions (Table 1). Region I had the highest proportion (96.7%), while CAR had the lowest (3.2%).

Table 2. The proportion of BEmONC RHUs that performed signal functions in the last 6-12 months, by signal function, 2021

	Personnel Capacity / Signal Function	(n, %)
SF1	Administration of parenteral antibiotics	96 (39.19%)
SF2	Administration of uterotonic drug	128 (52.24%)
SF3	Parenteral administration of anticonvulsants	84 (34.29%)
SF4	Assisted imminent breech delivery	58 (23.67%)
SF5	Parenteral administration of loading dose of maternal steroids during preterm labor	63 (25.71%)
SF6	Presence of partograph review	157 (64.08%)
SF7	Referral to CEmONC	190 (77.55%)
SF8	Newborn resuscitation	100 (40.82%)
SF9	Other maternal and newborn-related services	168 (68.57%)
SF10	Additional signal functions	123 (54.29%)

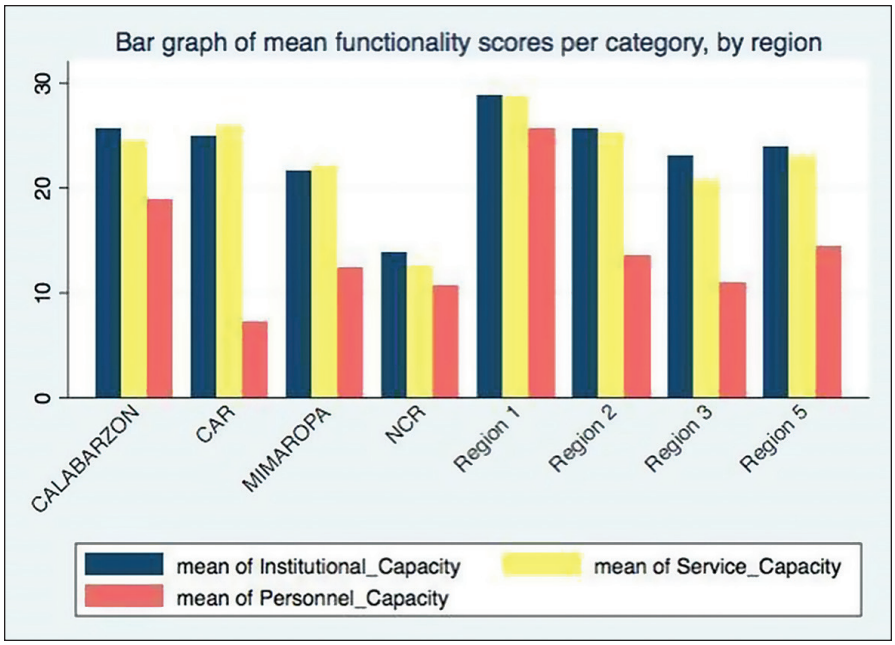

Figure 1. Mean functionality scores of the overall capacity of surveyed BEmONC facilities in Luzon, per region, 2021.

Overall Functionality

Using the scorecard, 85 of the 245 (35%) BEmONC-capable RHUs included in this study were adequately functional. The mean functionality score of 60±25.27 for Luzon corresponded to adequate functionality. In detail, the mean institutional and service capacities were consistently high on the entire island across all regions. But the personnel capacity did not reach the minimum average score, which pulled down the overall score, leading to a low overall functionality (Figure 1).

Interrupted Time Series Analysis of Secondary Data

In the review of secondary data, "other complications related to pregnancy" was the top causes of maternal death in the Philippines from 2000 to 2018. Diseases in this category included maternal care related to the fetus and amniotic cavity and possible delivery problems; complications of labor and delivery, such as failed induction of labor and abnormalities of the forces of labor; complications related to the puerperium, like puerperal sepsis and obstetric embolism; and other maternal disorders predominantly related to pregnancy, including excessive vomiting in pregnancy and diabetes in pregnancy, childbirth, and the puerperium. Hypertension complicating pregnancy, childbirth, and puerperium was the second most common cause of maternal death. Hemorrhage related to pregnancy was consistently the least common cause of death among the five categories.

In the analysis of FHSIS data, ante-natal care (ANC), post-partum care (PPC), FBD, and SBA were selected as proximal outcome indicators (Figure 2).

The establishment of BEmONC facilities was expected to increase access to maternal care and HCWs skilled in ante-natal, peri-natal, and post-partum care at the primary care level. Before the start of BEmONC in 2010, the annual change in FBD in selected provinces in Luzon was not statistically significant. After the introduction of BEmONC, a substantial increase in FBD was seen in all eight regions and significant annual growth of 8% in FBD rates.

Similarly, before 2010, there was no significant trend in SBA coverage and PPC in selected provinces of Luzon. After 2010, there was a marked and sustained increase in both (1.5% and 2% per year, respectively). Five of the eight regions showed marked increases in SBA coverage ranging from 1.4% to 4.7% per year.

However, ANC and infant mortality rate (IMR) did not show any significant trends from 2000 to 2018, even with the introduction of BEmONC services. There was a marked increase in MMR immediately after the start of BEmONC but did not continue in the following years.

Missing data for ANC, FBD, and MMR in some regions for 2005-2010 were replaced with "0", which may have affected the regression analysis results.

Luzon had a slightly lower MMR than the Philippine average. Among the regions in Luzon, Region 5 (Bicol Region) had the highest MMR, while the Cordillera Administrative Region (CAR) had the lowest. Among the areas in Luzon and the Philippines, there was no overall increasing trend in MMR.

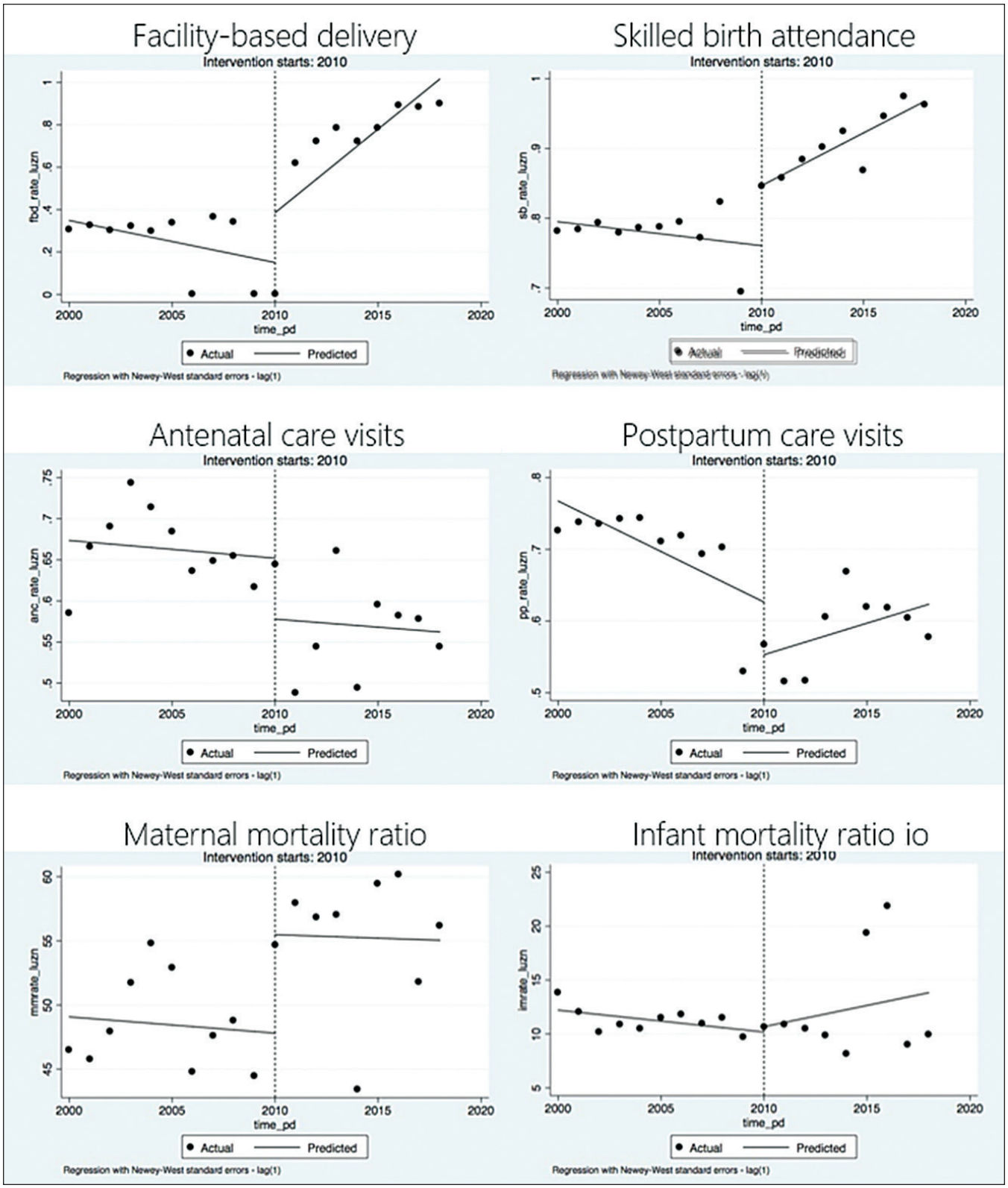

Figure 2. Interrupted time series analysis of reported FBD, SBA, ANC, PND, MMR, and IMR in selected provinces in the eight regions of Luzon, 2000 to 2018. The vertical line estimates the time of introduction of BEmONC (2010). Black dots represent the total number of deliveries per month. Solid lines are the predicted trends pre- and post-intervention, based on the ordinary least squares (OLS) method.

DISCUSSION

A fully functioning BEmONC-capable RHU has the capacity, in terms of facility and staffing, to deliver the maternal care and services needed to decrease maternal morbidity and mortality and therefore improve health outcomes. Specifically, these facilities should have the appropriate infrastructure, adequate personnel, and personnel who will perform specific interventions to fulfill their intended objectives. These were measured as institutional, service, and personnel capacity.

Results showed that the BEmONC-capable RHUs included in this study had high institutional and service capacities (~75%, adequate for both) but low personnel capacity in performing signal functions (35%, inadequate), pulling the mean functionality score down to the category of minimal functionality (60±25.27). Nonetheless, 35% of the facilities studied were adequately functioning. These findings provide insights into how the provision of BEmONC services has been implemented in Luzon over the last decade.

Functionality in Institutional and Service Capacities, But Not in Personnel Capacity

Scores from the scorecard reveal that BEmONC facilities can safely and efficiently provide maternal and newborn care in infrastructure and services. Establishing BEmONC-capable RHUs requires that such facilities are sustained and well-maintained. The provision for necessities like stable electrical supply, clean water, and paved road networks alongside reliable transportation facilities and qualified and experienced health personnel are vital in facilities mandated to provide basic routine services.[22-23] Accessible and well-equipped facilities encourage patients to consult and motivate HCWs to offer the best care, knowing they are working in an enabling environment. Improving health infrastructure in rural areas helps improve access to care, attracts skilled professionals, and reduces out-of-pocket expenses among patients seeking skilled maternal and newborn care.[22]

The majority of the surveyed facilities had at least one BEmONC-trained physician (73.5%), nurse (70.6%), and midwife (91.0%). However, there are instances when the BEmONC-trained staff is hesitant and cautious in performing emergency obstetric procedures and signal functions. In practice, BEmONC-trained staff often refer to high-risk cases, and many signal functions are not performed for a long time. Continuous training guided by regular monitoring and evaluation activities is needed. Despite the significant increase in the knowledge of HCWs in handling obstetric emergency cases after conducting workshops, more skills training should be done to improve competencies in partograph utilization and EINC interventions.[24,25]

Publicly-owned facilities should be upgraded to Basic EmONC status if they can perform signal functions alongside improving the human resource capacity, infrastructure, and supply chain.[26] This is similar to the findings of a 2014 United Nations Population Fund (UNFPA) study.[21] To have efficient BEmONC operations, there should be adequate and functional supplies, equipment, drugs, and infrastructure; available skilled HCWs 24/7; and an effective referral system for the timely transfer of maternal and neonatal patients between facilities.[27]

The organizational setup of RHUs also affects the actual performance of signal functions. If the BEmONC staff are to manage only the BEmONC program, the staff complement will be adequate. However, the lack of personnel will be felt if the team is tasked with other services and programs. The lack of personnel leads to poor management systems and may adversely impact other programs. The access and utilization of BEmONC services may be improved through community organizing[28] to encourage pregnant mothers to give birth in health facilities within their locality since it is readily available, as well as reassure them that HCWs with sufficient knowledge and experience handle these services.

Investment in human resources for health is key to development and success. A vital reform area is the DOH deployment programs, especially the Nurse Deployment Program and Rural Health Midwives Placement Program. Deployed personnel are currently not allowed to be BEmONC-trained and perform signal functions owing to the contractual nature of their employment. This prevents them from helping, and consequently, the responsibility of BEmONC falls on regular employees who are already overburdened. The recommended MNCHN staffing for the rapid reduction of maternal and neonatal mortality is one midwife per barangay health station (BHS), three BEmONC teams (composed of one doctor, one nurse, one midwife, and one medical technologist) per hospital, and one BEmONC team per RHU or BHS.[26]

Other Factors That May Affect BEmONC Functionality

The Philippines has no single set of comprehensive guidelines and protocols regarding maternal health care policies, technical standards, and service accessibility. Still, snippets of such information can be found in different documents.[29] Having a unified document on guidelines and protocols is crucial in providing high-quality maternal health care services since skilled HCWs can access important information more efficiently given the fast-paced work setting.[29]

Better coordination and support between the national and local government units (LGUs) can help minimize impediments to the provision of BEmONC services. Support of LGUs is essential in sustaining any facility. This is shown by the DOH's National Safe Motherhood Program, which aims to help the smallest unit in the country provide better maternal health services by working alongside LGUs. By establishing sustainable and cost-effective strategies, disadvantaged women can access health facilities within their locality that offer high-quality and acceptable maternal and newborn care "with a strong core knowledge base and support system."[30,31]

Full implementation of the Universal Health Care (UHC) Law and programs that will further support the country's SDG commitments may also affect the role of BEmONC in the overall scheme of healthcare delivery.[32] As the UHC Law strengthens primary-level care interventions, further developments in the service delivery networks will incorporate services offered by BEmONC-capable RHUs to improve overall health outcomes. This will open opportunities to revisit and resolve concerns that may hamper the functioning and utilization of BEmONC facilities.

BEmONC Signal Functions May Play A Role in Reducing MMR

The ITS analysis shows significant improvement in proximal outcomes such as FBD and SBA coverage but no substantial improvement in more distal indicators like MMR and IMR. An ITS regression analysis of facility-based deliveries per region in Luzon also shows similar significant improvements across all areas after introducing the BEmONC services. These findings are consistent with the results of the facility survey. There should be competent maternal and newborn health (MNH) professionals that can encourage communication and constructive teamwork across levels of health service delivery, together with their ability to provide adequate management to make BEmONC services effective and efficient.[33,34]

As impact level indicators, MMR and IMR are affected by factors other than those contributed by BEmONC-capable RHUs. Curbing maternal mortality can be done by reinforcing service delivery networks, promoting family planning, and successfully managing hemorrhage and hypertension-related emergencies.[35] This may be seen in the findings in CAR.

The findings in NCR provide an interesting picture. Highly urbanized and densely populated, the region has many non-functioning BEmONC facilities. The area has the lowest scores in institutional capacity, representing infrastructure, essential supplies, facility support, and in-service ability, representing staff complement and personnel. These findings are inconsistent with a resource-rich region at the heart of the country where the majority of health professionals as well as equipment and supply companies are located. One possible reason is that numerous CEmONC and higher-level facilities, both government and privately-owned, provide other options to mothers. Self-referral and bypassing gate-keeping mechanisms may also contribute to this phenomenon.[35,36] This warrants further studies to validate.

Currently, there is a lack of studies on BEmONC capacity in the Philippines. Aside from this study, only the baseline assessment conducted by the UNFPA in 2014 covered 95 selected facilities. The study revealed that 27% of facilities did not perform signal functions in the three months preceding the survey. Moreover, approximately half performed 1-2 signal functions, and only 4% achieved all of the signal functions.[21] Majority (77%) of the BEmONC facilities included in the baseline assessment were RHUs; the rest were either primary or district hospitals.

Across all regions, BEmONC remains relevant and much needed, albeit requiring reforms, enhancement, and updating. Although it may not have fulfilled all of its intended objectives, BEmONC facilities may be considered a social safety net for mothers and pregnant women, assuring them of better care when needed. This is seen in Tanzania, where there are unnecessary delays in treating pre-eclampsia/eclampsia, one of the country's leading causes of morbidity and mortality since the availability of anticonvulsants in public health care and lower-level facilities is a challenge.[36,37] In the Philippines, BEmONC-capable RHUs represents the government's continuing effort to strengthen health service delivery at the primary level. To improve this commitment toward better maternal and child care, a comprehensive assessment of BEmONC in the entire country should be undertaken.

Limitations of the Study

This study focused on the functionality of BEmONC-capable RHUs. It was not intended to evaluate the impact of these facilities on maternal morbidity and mortality as a whole, which would require a more comprehensive methodology and a longer time frame.

The scope of the facility survey was limited to BEmONC RHUs and did not include BEmONC-accredited private lying-in clinics and government-run district hospitals. Including these in future studies, as well as CEmONC facilities and community-level services, will provide a more in-depth look at how the MNCHN SDN contributes to reducing maternal mortality. The geographical scope was limited to the eight regions of Luzon, and the findings may not apply to the Visayas and Mindanao, which may have different infrastructure and staffing conditions than Luzon.

Secondary (FHSIS) data for outcome indicators was limited to selected provinces and contained missing data. Data were not missing at random, and no imputation was made.

CONCLUSIONS

Within the Philippine healthcare system, BEmONC facilities continue to play a role by filling in gaps and serving the needs of mothers and pregnant women. Most of the studied BEmONC facilities in Luzon are functional in terms of facility and personnel capacities, but their performance of signal functions, a critical intervention, can be improved further. Facilities that do not function are hampered mainly by factors that can easily be remedied. The provision of BEmONC services has varying effects on maternal mortality and remains relevant across all regions in Luzon. This must be continued if the overall effort to reduce maternal mortality succeeds. Under the DOH stewardship, BEmONC still represents the government's commitment to maternal health. Nonetheless, a similar study that covers the

Visayas and Mindanao should be done to obtain a complete representation of the BEmONC program.

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Statement of Authorship

All authors contributed in the conceptualization of work, acquisition and analysis of data, drafting and revising, and approved the final version submitted.

Author Disclosure

All authors declared no conflicts of interest.

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APPENDIX

Appendix 1. The proportion of BEmONC RHUs in Luzon with Adequate Institutional, Service, and Personnel Capacity, by MMR stratum, 2021

MMR stratum	Facilities with Adequate Institutional Capacity (n, %)	Facilities with Adequate Service Capacity (n,%)	Facilities with Adequate Personnel Capacity for Performance of Signal Functions (n, %)
Low	66 (81.5%)	67 (82.7%)	29 (35.8%)
Medium	57 (70.4%)	57 (70.4%)	28 (34.6%)
High	57 (68.7%)	60 (72.3%)	28 (33.7%)
Total	**180 (73.5%)**	**184 (75.1%)**	**85 (34.7%)**
Chi-squared test p values	**p = 0.132**	**p = 0.147**	**p = 0.962**