

## Preplanned Studies

## Analysis of Early Essential Newborn Care Capacities of Rural Health Facilities — Four Provinces in Western China, 2016

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### Summary

#### What is already known about this topic?

The Early Essential Newborn Care (EENC) intervention package recommended by World Health Organization (WHO) is shown to prevent and treat the leading causes of newborn illness and death. China has begun widespread implementation of the EENC.

#### What is added by this report?

Among the 14 core interventions, including using antibiotics for mothers with premature rupture of membranes, immediate skin-to-skin contact of mother and baby, delayed umbilical cord clamping, kangaroo mother care for preterm newborn, and neonatal sepsis and pneumonia management, were not sufficiently implemented in health facilities in western China.

#### What are the implications for public health practice?

There are gaps between the implementation situation and WHO recommendations in terms of EENC capacities in western China. Targeted interventions developed accordingly can ensure quality child health care and decrease newborn mortality in China.

China has achieved remarkable results in reducing under-five mortality rates, but the proportion of neonatal deaths remains high. In order to explore a pattern of early newborn health care service in China, the National Health Commission of the People's Republic of China (China NHC) cooperated with the United Nations International Children's Emergency Fund (UNICEF) to implement the "Safe Neonatal Project" in four western provinces in 2017. The purpose of this study was to understand the gaps between the implementation situation of project areas and the World Health Organization (WHO) recommendations in terms of early newborn health care capacities. A mail survey method was used to collect information of 233 midwifery hospitals in the 21 project counties of 4 western provinces. Descriptive statistical analysis was used to compare the

implementation coverage of the 14 core early newborn health care interventions recommended by the WHO. The results indicated that some core interventions were not well implemented, such as using antibiotics for mothers with premature rupture of membranes, immediate skin-to-skin contact between mother and baby, delayed umbilical cord clamping, kangaroo mother care for preterm newborn, and neonatal sepsis and pneumonia management. These results could provide a basis for developing targeted interventions and assessing the project impacts.

In 2017, the national neonatal mortality rate was 4.5‰ in China, accounting for 50% of deaths among children under five years old (1). The time of childbirth and the three days after birth is a critical period for neonatal survival and health. Early interventions in this period can effectively reduce neonatal mortality and improve long-term health outcomes (2). In 2014, the WHO published the "Action plan for healthy newborn infants in the Western Pacific Region (2014–2020)" and set targets for ending preventable neonatal deaths by 2020. Member States are recommended to implement the Early Essential Newborn Care (EENC), a package of evidence-based interventions shown to prevent and treat the leading causes of newborn illness and death (3–4). In 2017, China NHC and UNICEF jointly launched the three-year "Safe Neonatal Project" in four western provinces and introduced EENC. The purpose of this study was to evaluate the baseline situation of project areas in terms of early newborn health care capacities, understand the gaps between existing conditions and the recommendations, and provide a basis for developing targeted interventions.

This study was part of the baseline survey of the "Safe Neonatal Project". From June 2017 to September 2018, all midwifery hospitals in 21 project counties of Guizhou, Qinghai, and Sichuan provinces and Ningxia Autonomous Region participated in a mail survey to collect data. The questionnaire was

focused on the 14-core newborn health care interventions recommended by the WHO EENC guideline (Box 1) (5). Evaluation indicators included: basic information of hospitals, major maternal and child health outcomes, and implementing coverage rates of the core interventions. The questionnaires were issued by NHC through each provincial health authority to the hospitals. Provincial health authorities were responsible for providing training and guiding all counties and township level midwifery hospitals to fill out the questionnaire. All the collected data were the data by the end of 2016. No personal information was collected from individual patients and medical staff.

Data were entered into EpiData database using double-entry method. After the data were checked for quality and cleaned up, SPSS 22.0 (IBM, New York, USA) software was used for data analysis. Descriptive statistical analysis was used to compare the frequency and percentage of indicators among provinces.

There were 21 counties, 417 townships, and 5,352 villages in the project area. State-poverty counties accounted for 85.7% of all counties. There were 59

county-level and 211 township-level midwifery hospitals. A total of 233 midwifery hospitals completed the questionnaire, accounting for 86% of the targeted hospitals. In 2016, the population of 15 to 49 year-old women and 0 to 5 year-old children was 2.44 million and 0.52 million, respectively. The number of pregnant women was 95,430 and the number of live births was 95,764 (Table 1).

Regarding implementation of maternal health interventions, the gestational hypertension management rate (98.3%), maternal syphilis treatment rate (97.9%), and folic acid intake rate (88.8%) in the project area were high. The average cesarean section rate was 30.4%, of which 84.6% had medical indications. Approximately 60.1% of hospitals could implement antibiotics for management of preterm rupture of membranes, but only 77.3% of women with membrane preterm ruptures received this treatment. The average incidence of obstetric hemorrhage was 1.5%, and 70.9% of women received obstetric hemorrhage prevention interventions.

Regarding implementation of childbirth interventions,

Box 1. The 14-core newborn health care interventions recommended by EENC guideline.

Maternal health interventions	Childbirth interventions	Neonatal disease interventions
1. Maternal syphilis detection and treatment	7. Delayed umbilical cord clamping and proper care	11. Neonatal resuscitation
2. Gestational hypertension management	8. Immediate skin-to-skin contact of mother and newborn for at least 90 minutes after birth	12. Neonatal intramuscular injection of vitamin K <sub>1</sub>
3. Pregnant women take folic acid orally	9. Exclusive breastfeeding	13. Neonatal eye care
4. Antibiotics for management of preterm rupture of membranes	10. Kangaroo mother care for premature newborns	14. Common neonatal diseases diagnosis and treatment
5. Strict control of indications for cesarean section		
6. Prevention of obstetric hemorrhage		

TABLE 1. Basic information and key maternal and child health indicators of the 21 counties in 4 provinces in 2016.

Indicator	Guizhou	Ningxia	Qinghai	Sichuan	Total
Number of project counties	5	4	7	5	21
Number of project townships	108	47	101	161	417
Number of villages	1,705	506	1,220	1,921	5,352
Proportion of state-poverty county (%)	100	100	57.1	100	85.7
Number of county-level hospitals	13	6	16	24	59
Number of township-level hospitals	66	24	33	88	211
Total population (ten thousand)	267.8	100.8	167.6	375.0	911.2
Number of women aged 15–49 years old (ten thousand)	82.0	21.1	44.3	96.9	244.3
Number of children aged 0–5 years old (ten thousand)	16.5	8.4	11.4	16.0	52.3
Number of pregnant women	23,885	15,340	23,979	32,226	95,430
Number of live births	24,813	15,406	23,256	32,289	95,764

the proportion of immediate skin-to-skin contact of mother and newborn for at least 90 minutes after birth was 41.8%. Only 17.5% of newborns received delayed umbilical cord clamping, 24.7% of hospitals could implement kangaroo mother care (KMC) for premature newborns, 31.8% of preterm babies received any types of KMC, and 77.7% of newborns completed the first breastfeeding within 1 hour after birth. The exclusive breastfeeding rate at discharge was 83.8%.

Regarding implementation of neonatal disease interventions, the neonatal asphyxia rate was 3.2% in project area. The rate in Guizhou (6.1%) was higher than the other provinces, and the incidence of neonatal sepsis and neonatal pneumonia was 0.1% and 2.9%, respectively. The proportions of hospitals that carried out neonatal sepsis and pneumonia management were 33.5% and 47.8%, respectively. The rate of transferring newborns to neonatal intensive care unit (NICU) was 9.8%, with the rate in Guizhou (21.0%) higher than the other provinces. About 50.9% of hospitals carried out neonatal eye care intervention, and 74.2% of hospitals could implement intramuscular injection of vitamin K<sub>1</sub> to prevent intracranial hemorrhage, but only 69.8% newborns received this intervention (Table 2).

## Discussion

The EENC guidelines aim to improve the quality of maternal and child health care services in health facilities. Because of the higher risk of neonatal death during childbirth and within a few days after birth, the EENC guideline emphasizes interventions during this time period (5–7). The WHO has set an ambitious target that at least 80% of midwifery hospitals in each Member States should have fully implemented EENC by 2020 (3). The current study found that, in the project area of the “Safe Neonatal Project”, there are gaps between the current implementation and the WHO recommendations.

Although the coverage of major maternal health care services was high, some interventions still need improvement. For example, the use of antibiotics in mothers with premature rupture of membranes is an effective intervention to prevent neonatal infectious diseases. About 60.1% of the hospitals carried out this intervention, but around 40% of patients with medical indications did not receive this treatment. The average cesarean section rate in project areas was close to the national cesarean section rate (34.1%) and rural

cesarean section rate (30.3%) (1).

In terms of interventions during childbirth, the implementation rates of immediate skin-to-skin contact (41.8%), delayed umbilical cord clamping (17.5%), and kangaroo mother care for preterm newborn (24.7%) were below WHO targets (80%). A previous study conducted in the same area found that medical staff had a misunderstanding on the concept of “skin-to-skin contact between mother and baby” (8). According to the EENC guideline, skin-to-skin contact should be the contact of bare breast and belly, rather than face-to-face contact (9). The results also indicated that, although more than 60% of hospitals reported they could implement delayed umbilical cord clamping, only 17.5% of newborns received this treatment. Further research is needed to explore barriers that hinder the implementation of this intervention.

In terms of neonatal disease interventions, less than 50% of hospitals could carry out neonatal sepsis and pneumonia diagnosis and treatment services. This was also below the WHO target (80%). In addition, there were gaps among provinces in the NICU transferring rate. NICU transfer rate is related to the diagnosis and treatment capacity, but on the other hand, it is also influenced by the mastery of medical indications (8). Unnecessary NICU transfer and excessive medical interventions may not only increase the economic burden of patients, but may also negatively affect the health of newborns (10).

This study has some limitations. First, data was self-reported by hospitals. Due to the differences in understanding of study significance, data collection capacity, and workload among hospitals, reporting bias may exist. Second, self-reported data might overestimate the actual implementation of these interventions. A previous study conducted in the same areas collected data using face-to-face interviews with women after delivery (8), and the results indicated the proportion of immediate skin-to-skin contact of mother and newborn after birth was 36.1%, which was lower than finding of this study (41.8%). Third, most of the project counties are state-poverty counties. The health care resources and capacities cannot represent the level of the province. The results may not be extrapolated to the whole province or the country. Nevertheless, this is the first study to investigate the current situation of EENC implementation in base-level hospitals in China. The results may provide directions for further research and for developing targeted interventions.

TABLE 2. Comparison of coverage of 14 EENC core interventions of the 21 counties in 4 provinces in 2016 (%).

Core intervention	Indicator	Guizhou	Ningxia	Qinghai	Sichuan	Total
1. Maternal syphilis detection and treatment	Treatment rate of pregnant women with syphilis	83/83 (100)	11/12 (91.7)	132/137 (96.4)	49/49 (100)	275/281 (97.9)
2. Gestational hypertension management	Management rate of pregnant women with hypertension	235/235 (100)	355/355 (100)	268/268 (100)	54/70 (77.1)	912/928 (98.3)
3. Pregnant women take folic acid	Folic acid intake rate	22,295/24,199 (92.1)	14,143/14,740 (95.9)	15,993/21,598 (74.0)	27,706/29,682 (93.3)	80,137/90,219 (88.8)
4. Strict control of indications for cesarean section	Cesarean section rate Cesarean section with medical indications	8,123/24,153 (33.6)	2,321/14,712 (15.8)	2,695/21,303 (12.7)	14,058/29,395 (47.8)	27,197/89,563 (30.4)
5. Antibiotics for management of preterm rupture of membranes	Proportion of hospitals implemented	6,498/8,123 (80)	2,265/2,321 (97.6)	2,578/2,695 (95.7)	11,673/14,058 (83)	23,014/27,197 (84.6)
6. Prevention of obstetric hemorrhage	Proportion of hospitals implemented	38/60 (63.3)	12/19 (63.2)	14/44 (31.8)	76/110 (69.1)	140/233 (60.1)
	Incidence of obstetric hemorrhage	932/1,083 (86.1)	1,571/1,712 (91.8)	1,329/1,636 (81.2)	1,062/1,904 (55.8)	4,894/6,335 (77.3)
	Obstetric hemorrhage mortality (100 thousand)	581/24,199 (2.4)	258/14,740 (1.8)	247/21,598 (1.1)	258/29,682 (0.9)	1,344/90,219 (1.5)
7. Neonatal resuscitation	Incidence of birth asphyxia	0/24,199 (0)	1/14,740 (6.8)	0/21,598 (0)	0/29,682 (0)	1/90,219 (1.1)
	Incidence of birth asphyxia	1,474/24,153 (6.1)	293/14,712 (2)	846/21,303 (4)	241/29,395 (0.8)	2,854/89,563 (3.2)
	NICU transfer rate	5,067/24,153 (21)	1,377/14,712 (9.4)	1,055/21,303 (5)	1,284/29,395 (4.4)	8,783/89,563 (9.8)
8. Immediate skin-to-skin contact of mother and newborn for at least 90 minutes after birth	Proportion of hospitals implemented	12/60 (20)	1/19 (5.3)	2/44 (4.5)	5/98 (5.1)	20/221 (9)
	Proportion of babies skin to skin contact for at least 90 minutes	5,636/24,153 (23.3)	7,927/14,712 (53.9)	7,648/21,303 (35.9)	16,251/29,395 (55.3)	37,462/89,563 (41.8)
9. Exclusive breastfeeding	First breastfeeding within 1 hour after birth	17,475/24,153 (72.4)	9,419/14,712 (64)	17,522/214,303 (82.3)	25,147/29,395 (85.5)	69,563/89,563 (77.7)
	Exclusive breastfeeding at discharge	18,907/24,153 (78.3)	12,474/14,712 (84.8)	17,998/21,303 (84.5)	25,657/29,395 (87.3)	75,036/89,563 (83.8)
10. Delayed umbilical cord clamping and proper care	Delayed umbilical cord clamping rate	1,992/24,153 (8.2)	2,101/14,712 (14.3)	3,734/21,303 (17.5)	7,861/29,395 (26.7)	15,688/89,563 (17.5)
	Neonatal umbilical infection rate	7/24,153 (0)	22/14,712 (0.1)	54/21,303 (0.3)	1/29,395 (0)	84/89,563 (0.1)
11. Neonatal eye care	Proportion of hospitals implemented	43/60 (71.7)	6/19 (31.6)	15/44 (34.1)	54/109 (49.5)	118/232 (50.9)
	Incidence of neonatal eye infection	27/24,153 (0.1)	16/14,712 (0.1)	273/21,303 (1.3)	127/29,395 (0.4)	443/89,563 (0.5)
12. Neonatal intramuscular injection of vitamin K <sub>1</sub>	Proportion of hospitals implemented	49/60 (81.7)	14/19 (73.7)	21/44 (47.7)	89/110 (80.9)	173/233 (74.2)
	Vitamin K <sub>1</sub> injection rate	19,143/24,153 (79.3)	12,484/14,712 (84.9)	11,538/21,303 (54.2)	19,321/29,395 (65.7)	62,486/89,563 (69.8)
13. Kangaroo mother care for premature newborns	Proportion of hospitals implemented	21/60 (35)	6/19 (31.6)	6/44 (13.6)	24/108 (22.2)	57/231 (24.7)
	Proportion of babies received	36/520 (6.9)	331/626 (52.9)	39/487 (8)	291/556 (52.3)	697/2,189 (31.8)
	Proportion of hospitals implemented neonatal sepsis management	29/59 (49.2)	6/19 (31.6)	6/43 (14)	36/109 (33)	77/230 (33.5)
14. Common neonatal diseases diagnosis and treatment	Proportion of hospitals implemented neonatal pneumonia management	39/60 (65)	9/19 (47.4)	16/44 (36.4)	47/109 (43.1)	111/232 (47.8)
	Incidence of neonatal sepsis	31/24,153 (0.1)	58/14,712 (0.4)	17/21,303 (0.1)	1/29,395 (0)	107/89,563 (0.1)
	Incidence of neonatal pneumonia	691/24,153 (2.9)	503/14,712 (3.4)	708/21,303 (3.3)	659/29,395 (2.2)	2,561/89,563 (2.9)

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## References

1. Department of Maternal and Child Health, National Health Commission of the People’s Republic of China. 2018 National maternal and child health analysis report. [2018-11-15].
2. Bundy DAP, de Silva N, Horton S, Patton GC, Schultz L, Schultz DT, et al. Disease Control Priorities-3 Child and Adolescent Health and Development Authors Group. Investment in child and adolescent health and development: key messages from Disease Control Priorities, 3rd Edition. *Lancet* 2018;391(10121):687 – 99. [https://www.thelancet.com/journals/lancet/article/PIIS0140-6736\(17\)32417-0/fulltext](https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(17)32417-0/fulltext).
3. World Health Organization Regional Office for the Western Pacific & United Nations Children’s Fund. Action plan for healthy newborn infants in the Western Pacific Region (2014–2020). Manila, 2014. <https://www.healthynewbornnetwork.org/resource/first-biennial-progress-report-action-plan-healthy-newborn-infants-western-pacific-region-2014-2020/>.
4. Sobel HL, Silvestre MA, Mantaring III JBV, Oliveros YE, Soe NU. Immediate newborn care practices delay thermoregulation and breastfeeding initiation. *Acta Paediatr* 2011;100(8):1127 – 33. <http://dx.doi.org/10.1111/j.1651-2227.2011.02215.x>.
5. Tran HT, Mannava P, Murray JCS, Nguyen PTT, Tuyen LTM, Tuan HA, et al. Early essential newborn care is associated with reduced adverse neonatal outcomes in a tertiary hospital in Da Nang, Viet Nam: A pre- post-intervention study. *EClinicalMedicine* 2019;6:51 – 8. <http://dx.doi.org/10.1016/j.eclinm.2018.12.002>.
6. Li X, Xu T. The theory and practice of the World Health Organization recommended Early Essential Newborn Care (EENC). *Chin J of Perinat Med* 2017;20(9):689 – 91. [http://www.wanfangdata.com.cn/details/detail.do?\\_type=perio&id=zhwcyzz201709014](http://www.wanfangdata.com.cn/details/detail.do?_type=perio&id=zhwcyzz201709014). (In Chinese).
7. Chinese Society of Perinatal Medicine, Chinese Nursing Association, National Center for Women and Children’s Health China CDC. Clinical implement recommendations on the Early Essential Newborn Care (Beijing 2017). *Chin J of Perinat Med* 2018;34(1):5 – 8. <http://dx.doi.org/10.3760/cma.j.issn.1007-9408.2018.12.103>. (In Chinese).
8. Yangjin LX, Li XY, Wang Y, Xiao Yue, Qiu YP, Shi LW, et al. Situation analysis of Early Essential Newborn Care services in county level health facilities in four western provinces of China. *Matern & Child Health Care of China* 2019;34(10):3 – 8. <http://dx.doi.org/10.3760/cma.j.issn.1007-9408.2018.12.103>. (In Chinese).
9. Zhang L, Zhang Y, Zhang W, He X. Impact of delayed umbilical cord clamping on the health outcome of late preterm children. *J Child Health Care* 2018;194(8):37 – 9. [http://www.wanfangdata.com.cn/details/detail.do?\\_type=perio&id=zgetbjzz201808009](http://www.wanfangdata.com.cn/details/detail.do?_type=perio&id=zgetbjzz201808009). (In Chinese).
10. Xu T, Yue Q, Wang Y, Murray J, Sobel H. Childbirth and early newborn care practices in 4 provinces in China: a comparison with WHO recommendations. *Glob Health Sci Pract* 2018;6(3):565 – 73. <http://dx.doi.org/10.9745/GHSP-D-18-00017>.