Clinical paper

The impact of an intervention package promoting effective neonatal resuscitation training in rural China[☆]

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ABSTRACT

Objective: To evaluate an intervention package promoting effective neonatal resuscitation training at county level hospitals across China.

Methods: The intervention package was implemented across 4 counties and included expert seminars, training workshops, establishment of hospital-based resuscitation teams, and supervision of training by national and provincial instructors. Upon completing the activities, a survey was conducted in all county hospitals in the 4 intervention counties and 4 randomly selected control counties. Data on healthcare providers' knowledge and self-confidence, and incidence of deaths from birth asphyxia from 2009 to 2011 in all hospitals were collected and compared between the two groups.

Results: Eleven intervention and eleven control hospitals participated in the evaluation, with 97 and 87 health providers, respectively, completing the questionnaire survey. Over 90% of intervention hospitals had implemented neonatal resuscitation related practice protocols, while in control hospitals the proportion was less than 55%. The average knowledge scores of health providers in the intervention and control counties taking a written exam were 9.2 ± 1.2 and 8.4 ± 1.5, respectively ($P < 0.001$) out of maximum possible score of 10, and the average self-confidence scores were 57.3 ± 2.5 and 54.1 ± 8.2, respectively ($P < 0.001$). Incidence of birth asphyxia (defined as 1-min Apgar score ≤ 7) decreased from 8.8% to 6.0% ($P < 0.001$) in the intervention counties, and asphyxia-related deaths in the delivery room decreased from 27.6 to 5.0 per 100,000 ($P = 0.076$). There was no difference over time in asphyxia rates for the control counties.

Conclusions: The intervention has not only improved skills of health providers, decreased the mortality and morbidity of birth asphyxia, but also resulted in effective implementation of guidelines and protocols within hospitals.

1. Introduction

Neonatal asphyxia is one of the major causes of neonatal mortality and disability around the world. About one quarter of the world's neonatal deaths are due to neonatal asphyxia.[1] In China, the infant mortality rate (IMR) averaged 13.1 deaths per 1000 live births in 2010[2]; however, disparity existed between urbanized areas, with an average IMR as low as 5.8 per 1000 live births and rural areas with an average IMR of 16.1 per 1000 live births. Of all infant deaths, 17.1% resulted from intrapartum hypoxic-ischemic events (asphyxia).[3] The Chinese Ministry of Health (MOH) identified perinatal asphyxia as a health priority for the country in 2005.[4] In order to effectively reduce child mortality and disability, a major priority was to strengthen the neonatal resuscitation capacity among healthcare providers, especially in rural areas.

The Chinese healthcare system follows the administrative hierarchy of the People's Republic of China (province, prefecture, county in descending order) for the organization of services (Fig. 1). Provincial maternal–child health care hospitals, usually in the
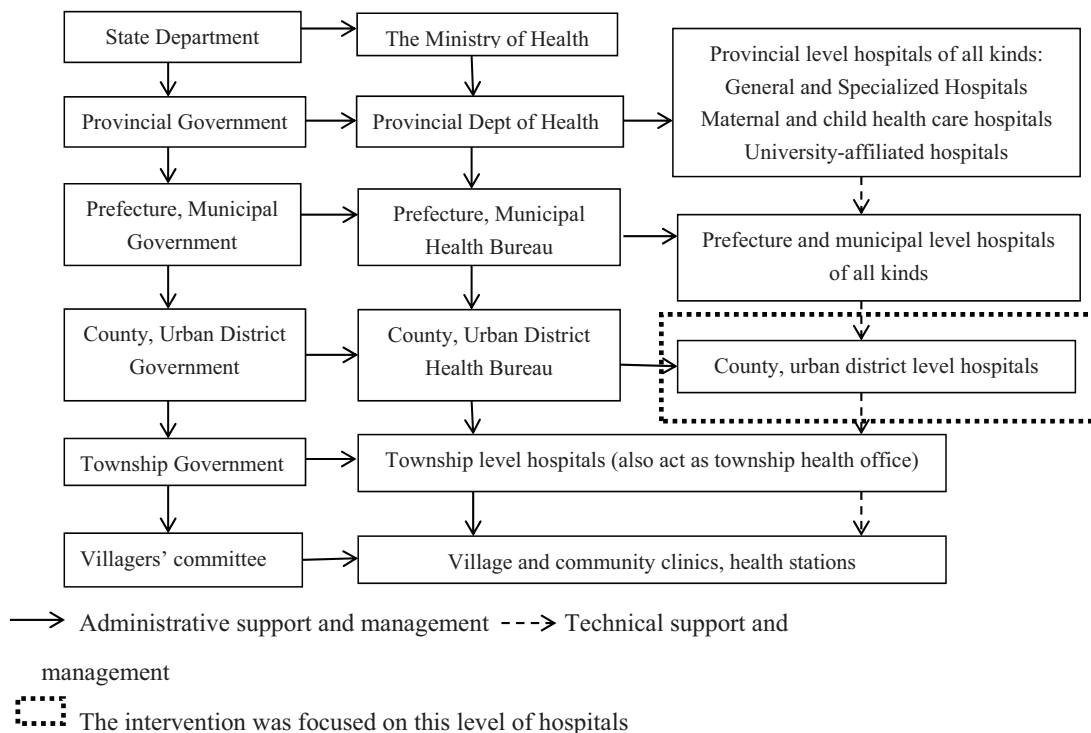
Fig. 1. Organization structure of China's healthcare system.

capital cities, receive referrals of complex cases in addition to caring for routine births.[5] Prefecture and university-affiliated hospitals in larger cities provide subspecialty intensive care. Municipal hospitals offer variable subspecialty services, and county (or urban district) hospitals focus on routine and intermediate care, including comprehensive emergency obstetric care. Township health centers manage uncomplicated births and offer basic emergency obstetric care. Village and urban community clinics focus on prenatal and postnatal care.[6] Within this healthcare system, county hospitals play a leading role in providing quality delivery and neonatal health care services for the grassroots communities. Thus it is pivotal to improve the capacity of neonatal resuscitation among county level hospitals (Fig. 1).

Neonatal resuscitation practice varied widely in its content and availability across China before 2004.[7,8] In order to increase the availability of education in neonatal resuscitation, the Chinese MOH launched the first phase of national implementation of the Neonatal Resuscitation Program in collaboration with the Johnson and Johnson Pediatric Institute LLC (JJPI) and the American Academy of Pediatrics (AAP) in July 2004.[9] From 2004 through 2009 more than 110,659 professionals received NRP training in the 20 target provinces, with 94% of delivery facilities and 99% of counties reached. Asphyxia-related deaths in the delivery room decreased from 7.5 to 3.4 per 10,000 from 2003 to 2008, and the incidence of Apgar ≤ 7 at 1 min decreased from 6.3% to 2.9%.[10]

Despite considerable reach and effectiveness of the NRP program, there are some challenges that need to be addressed. First, very high demand for training resulted in large numbers of learners per course and limited the opportunities for practising skills.[11] Second, there was insufficient priority given to training in counties and townships, especially in rural areas and urban poor populations, in order to reduce disparities in mortality between rural and urban areas and among regions.[12] Third, we recognized that achieving the goal of at least one person trained in neonatal resuscitation at every delivery would require continuation and expansion of the initiative.

From February 2009 through February 2012, a three-year pilot intervention study exploring effective neonatal resuscitation training model in rural China was launched with the cooperation of multiple agencies, including the China–Australia Health and HIV/AIDS Facility (CAHHF).[a] We tested the hypothesis that implementation of a comprehensive intervention package, which included expert seminars, cascading training workshops and establishment of hospital-based resuscitation teams would improve dissemination of NRP and thus decrease neonatal morbidity and mortality in rural areas.

2. Methods

2.1. Study sites and participants

The study was conducted in Shandong and Heilongjiang, two eastern provinces of China. According to the 2011 data from the National Bureau of Statistics, there are 91 and 65 counties in the two provinces respectively. Covered by the policy of free or subsidized hospital delivery to rural women, the average hospital delivery rate is above 99% in these provinces.[b13,14]

Eight counties (four from each province) were randomly selected to participate in the study. Four counties (two from each province) were randomly assigned to the intervention group and four counties to the control group. Medical staff in all of the 11 county level hospitals in the intervention group were trained using the neonatal resuscitation intervention package, while those in the 11 county level hospitals in the control group only received routine