

**Neonatal Mortality in Low and Lower-Middle Income
Countries: Which Areas Require Further Attention?
Evidence from Bangladesh**

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A thesis submitted for the degree of Doctor of Philosophy,
University of Technology Sydney

June 2018

Certificate of Original Authorship

I certify that the work in this thesis has not previously been submitted for a degree nor has it been submitted as part of requirements for a degree except as part of the collaborative doctoral degree and/or fully acknowledged within the text.

I also certify that the thesis has been written by me. Any help that I have received in my research work and the preparation of the thesis itself has been acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

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Statement of Contributions of Jointly Authored Works

The research works presented in this thesis have been submitted for publication in peer-reviewed journals through six articles (one literature review paper and five original articles), presented in Chapter 2 and Chapter 4 to Chapter 8. For each of these papers, I have been primarily responsible for determining the research question, undertaking the analysis and drafting the manuscript.

I have received support in all of these areas from Professor David Sibbritt and Associate Professor Angela Dawson.

I take full responsibility for the accuracy of the findings presented in these publications and in this thesis.

Published Works Incorporated into the Thesis

1. Akter T, Sibbritt D, & Dawson A. (2016). Workforce interventions to deliver postnatal care to improve neonatal outcomes in low-and lower-middle-income countries a narrative synthesis. *Asia Pacific Journal of Public Health*, 28(8), 659-681.
2. Akter T, Dawson A, & Sibbritt D. (2015). What impact do essential newborn care practices have on neonatal mortality in low and lower-middle income countries? Evidence from Bangladesh. *Journal of Perinatology*, 36(3), 225-230.
3. Akter T, Dawson A, & Sibbritt D. (2016). The determinants of essential newborn care for home births in Bangladesh. *Public Health*, 141(12), 7-16.
4. Akter T, Dawson A, & Sibbritt D. (2017). What impact does antenatal and postnatal care have on neonatal deaths in low- and lower-middle-income countries? Evidence from Bangladesh. *Health Care for Women International*, 38(8), 848-860.
5. Akter T, Dawson A, & Sibbritt D. (2018). Changes in neonatal mortality and newborn healthcare practices: descriptive data from the Bangladesh Demographic and Health Surveys 2011 and 2014. *WHO South-East Asia Journal of Public Health*, 7(1), 43-50.

Conference Presentations

Akter T, Dawson A, & Sibbritt D. Recent Trends in Newborn Health Practices and Mortality: Evidence from Bangladesh Demographic and Health Survey. *15th World Congress on Public Health 2017, Melbourne, Australia.*

Akter T, Dawson A, & Sibbritt D. What Factors are Associated with the Utilization of Antenatal Care Services in Low and Lower-Middle Income Countries? Evidence from Bangladesh. *Perinatal Society of Australia & New Zealand (PSANZ) Conference 2017, Canberra, Australia.*

Acknowledgements

I would like to thank and acknowledge all those who have encouraged and supported me in completing my PhD journey.

First and foremost, I owe heartfelt thanks to my supervisors Professor David Sibbritt and Associate Professor Angela Dawson. Without their guidance, insightful advice and constructive feedback, I would not have been able to complete this thesis. They have not only guided me to increase my knowledge in research but also shaped me as a researcher and an academic. In addition, they extended their support to my daily life, which has been beyond a supervisor's responsibility. I hope I am able to thank them appropriately.

I am grateful to the Australian Government for offering me the Endeavour Postgraduate Award, without which my PhD would never have been possible. Further, I would like to offer my sincere thanks to the Demographic and Health Survey (DHS) program for allowing me to use their data in my research.

I am particularly indebted to Dr. Shams El Arifeen of the International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B) for encouraging me to undertake research and initiating my dream of pursuing a PhD. I am also thankful to Dr Melissa Russell from the University of Melbourne for inspiring me to continue my research and to be an academic.

Thank you my friends, PhD peers and colleagues, who motivated me on every step of the PhD candidature. I am particularly appreciative of Wenbo Peng, Kyoungrim Kang, Lu Yang, Sara Shishehgar and Dwi Linna Suswardany – for their academic and non-academic contribution to my PhD life. I would also like to thank Matthew Sidebotham for helping me to check grammatical issues in my thesis. Many thanks to Priya Nair for her caring administrative support.

I am incredibly thankful to my parents and brother Nehal. They give me endless love and support in every way possible. Their love and patience have sustained me and helped me achieve my dream. I thank my husband, Hasan, who accompanied me the whole period of my PhD and made every effort to finish the journey. Finally, I wish to thank my preschooler son, Tamjeed, whose every motion makes me laugh and surely makes my day and at the end of the day, I live and breathe for him.

Abbreviations

ANC	Antenatal Care
BDHS	Bangladesh Demographic and Health Survey
CBSV	Community-based Surveillance Volunteer
CHC	Community Health Committee
CHW	Community Health Worker
CI	Confidence Interval
CSBA	Community-based Skilled Birth Attendant
DGHS	Directorate General of Health Services
DHS	Demographic and Health Survey
ENC	Essential Newborn Care
HDI	Human Development Indicator
HPNSDP	Health, Population and Nutrition Sector Development Program
HRH	Human Resources for Health
HR	Hazard Ratio
LHW	Lady Health Worker
LMIC	Low and Lower-Middle Income Country
MCH	Maternal and Child Health
MNCH	Maternal, Newborn and Child Health
MDG	Millennium Development Goal
MOHFW	Ministry of Health and Family Welfare
NGO	Non-Governmental Organization
NIPORT	National Institute of Population Research and Training
NMR	Neonatal Mortality Rate
OR	Odds Ratio
PICOS	Population, Interventions, Comparators, Outcomes, Study design
PMNCH	Partnership for Maternal, Newborn and Child Health

PMR	Perinatal Mortality Rate
PNC	Postnatal Care
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
RCT	Randomized controlled trial
SBA	Skilled Birth Attendant
SD	Standard Deviation
SDG	Sustainable Development Goal
SES	Socioeconomic Status
TBA	Traditional Birth Attendant
UNDP	United Nations Development Programme
UNICEF	United Nations Children's Fund
VHW	Village Health Worker
WHO	World Health Organization

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Abstract

Background

The global neonatal mortality rate (NMR) is still high, estimated at 19 deaths per 1,000 live births in 2015, which accounts for 45 percent of under-five deaths. Neonatal deaths are projected to increase to 52 percent of under-five deaths in 2030, with most deaths occurring in low and lower-middle income countries (LMICs). This research aimed to examine the key factors that affect the neonatal mortality in LMICs, with a focus on Bangladesh.

Methods

This study comprised a systematic review and statistical analyses. The systematic review, using a narrative synthesis methodology, first examined the impact of workforce interventions on neonatal outcomes in LMICs. Statistical analyses of the 2011 Bangladesh Demographic and Health Survey (DHS) data (n=17,842) investigated the key components of health care services, including facility-based delivery, skilled birth attendants (SBAs), essential newborn care (ENC), antenatal care (ANC) and postnatal care (PNC). In addition, statistical analyses of DHS data from Nepal (n=12,674) and Pakistan (n=13,558) were undertaken to compare the impact of facility-based delivery and/or SBAs in reducing NMR in those countries. A separate statistical analysis of the 2014 Bangladesh DHS data (n=17,863) investigated the changes over time in newborn health care practices, from 2011 to 2014. Statistical analyses used in this research included chi-square tests, multiple logistic regression models and Cox proportional hazards regression models.

Results

The systematic review found that competency assessment, the acquisition of appropriate skills and supervisory guidelines can improve health professional performance. An empirical investigation of Bangladesh DHS data revealed an improvement in health care practices over time for all socio-demographic groups in the country. A detailed investigation suggested that neonatal mortality significantly decreased for newborns whose mothers received ANC services (HR=0.52; 95% CI: 0.29, 0.96). The ENC practice of delayed bathing significantly contributed to reducing neonatal mortality in

Bangladesh (OR=0.14; 95% CI: 0.03, 0.68). However, other ENC practices including PNC and skilled assistance during delivery were not found to be significantly associated with neonate deaths. Furthermore, neonatal mortality was significantly higher for facility deliveries compared to home deliveries in Bangladesh (OR=2.43; 95% CI: 1.09, 5.41). Nepal and Pakistan DHS data also failed to confirm any significant effect of facility delivery and/or SBAs on neonatal mortality.

Conclusions

This is the first study to examine the impact of different components of health care practices on neonatal mortality in Bangladesh at a national level and provides important recommendations for saving newborn lives. First, guidelines related to the fabric used for the immediate drying and wrapping of newborns are required to improve hygiene at a baby's birth. Second, increased emphasis on parental education is required to improve the uptake of ENC services. Third, investment in promoting ANC is important to accelerate the reduction of neonatal deaths. Fourth, revisiting current health intervention programs related to PNC in Bangladesh are essential to better understand the impact of PNC on neonatal mortality. Finally, standardized workforce training and staff supervision are required to improve the performance of health providers. Nevertheless, more research is required to better understand neonatal mortality in LMICs, particularly the reasons why the risk of neonatal deaths increases for deliveries at health facilities and why some ENC practices do not have any impact on neonatal mortality.