

UNDERSTANDING NEONATAL MORTALITY IN PAPUA NEW GUINEA: A
DESCRIPTIVE ANALYSIS OF REGIONAL BIRTHING PRACTICES AND
IMPLEMENTATION OF NEONATAL RESUSCITATION

by

KENDRA KELLY

DISSERTATION

Presented to the Faculty of the Medical School
The University of Texas Southwestern Medical Center
In Partial Fulfillment of the Requirements
For the Degree of

DOCTOR OF MEDICINE WITH DISTINCTION IN GLOBAL HEALTH

The University of Texas Southwestern Medical Center
Dallas, TX

© Copyright by Kendra Kelly 2018
All Rights Reserved

ACKNOWLEDGMENTS

I would like to acknowledge the support of my mentor, Dr. Rachel Jamison, whose insight and encouragement inspired me and helped make this project possible. Throughout multiple trips abroad, my family's continual understanding and reassurance was invaluable. I also offer my gratitude to the UT Southwestern Office of Global Health and Project Hope Northwest for their financial support. Mostly, I want to thank the Tigak people who invited me into their culture and their lives—this project is for you. Giro.

ABSTRACT

UNDERSTANDING NEONATAL MORTALITY IN PAPUA NEW GUINEA: A
DESCRIPTIVE ANALYSIS OF REGIONAL BIRTHING PRACTICES AND
IMPLEMENTATION OF NEONATAL RESUSCITATION

KENDRA KELLY

The University of Texas Southwestern Medical Center, 2018

Supervising Professor: Rachel Jamison, M.D.

Background: Papua New Guinea (PNG) did not fully meet all 8 Millennium Development Goals outlined by the United Nations—including goal number 4 to reduce child mortality. While the under-5 mortality ratio decreased between 2004-2015, the neonatal mortality ratio remained unchanged. Previous interventions aimed at reducing neonatal mortality have been effective in other low-resource settings; however, little data exists regarding the standard of obstetric and neonatal care in PNG, particularly at a regional level.

Objective: To evaluate and compare existing birthing practices both in the regional hospital and among one rural people group within PNG prior to identifying and providing an appropriate intervention with a primary goal of reducing neonatal mortality.

Methods: This study was completed in 2 phases. In the first phase (2015), birthing practices among two distinct populations in PNG were described after 35 vaginal deliveries were directly observed at the provincial hospital and 31 oral interviews were completed on a nearby island with mothers who had previous rural deliveries. After identifying neonatal resuscitation training as a need among village midwives, Helping Babies Breathe (HBB) training was implemented during the second phase of the project (2018).

Results: Despite traveling an average distance of 22.3 km to reach the hospital, women who delivered at the hospital were more likely to have received prenatal care (91%) compared to only 58% of women who delivered on the island (located 12.5 km away). Prior to the HBB training, hand hygiene was utilized before all hospital deliveries and only before 1 rural delivery. Infants born on the island were rarely dried and stimulated immediately (13%), while this practice was part of routine care at the hospital (94%). Clean supplies were used to cut the umbilical cord for just over half the island deliveries (52%) compared to all of the hospital births. On the island, 61% of deliveries were attended by a village midwife and 22.6% of neonates died (compared to 8.6% at the hospital). 17 women from the island underwent HBB training in 2018. Compared to a pre-course assessment, there was a 100% increase in the number of participants who correctly washed their hands. Additionally, 82%

immediately dried and stimulated the baby and 65% correctly provided ventilation (increase from 0 and 6%, respectively).

Conclusion: There is a large discrepancy of routine newborn care within the hospital and rural populations in the New Ireland Province, including higher rates of neonatal mortality among babies born on the island. Standardized neonatal resuscitation training can be effectively delivered to village midwives in this region despite no previous training and high illiteracy rates. Further studies are needed to determine the long-term retention among trained providers and the regional effect on neonatal mortality.

TABLE OF CONTENTS

INTRODUCTION -----	2
METHODS -----	7
<i>Description of Current Birthing Practices in Papua New Guinea's New Ireland Province</i> ---	7
<i>Assessment of Village Midwife Practices</i> -----	8
<i>Implementation of Neonatal Resuscitation and Newborn Care Training</i> -----	8
RESULTS-----	10
<i>Population Demographics</i> -----	10
<i>Obstetric and Pediatric Standards of Care in Papua New Guinea's New Ireland Province</i> -	11
<i>Traditional Birthing Practices on Limanak Island</i> -----	12
<i>Comparison of Hospital and Village Deliveries in New Ireland Province</i> -----	13
<i>Village Midwife Education</i> -----	15
<i>Neonatal Resuscitation Education</i> -----	15
CONCLUSIONS AND RECOMMENDATIONS -----	19
LIST OF FIGURES -----	21
REFERENCES-----	22
APPENDICES -----	24
<i>Appendix A: Village Delivery Interview</i> -----	24
<i>Appendix B: Village Midwife Interview</i> -----	26
VITAE-----	28

INTRODUCTION

Papua New Guinea (PNG), the largest of the Pacific Island countries, is located north of Australia and comprises the eastern half of the New Guinea landmass as well as the surrounding islands. The country is one of the most culturally and geographically diverse places in the world with over 800 distinct people groups and languages located across an estimated 6,000 islands.¹ Nearly 87% of the population live in rural communities, some of which are considered inaccessible by the local government, significantly limiting access to healthcare throughout the country.¹⁻²

During a General Assembly meeting in September of 2000, the United Nations created a declaration for the new millennium with a mission of addressing the world's greatest developmental needs (identified from 1990-2000) by the year 2015.³ This declaration formed the basis of the Millennium Development Goals (MDGs). The eight MDGs ranged from eradicating extreme poverty and hunger (goal 1) to establishing a global partnership for development (goal 8) as well as reducing both child and maternal mortality rates (goals 4 and 5, respectively).

According to PNG's 2015 MDG summary report, PNG did not fully meet all eight goals.¹ Despite overall improvements in national mortality statistics in PNG, the under-5 mortality ratio (U5MR) only decreased by one third, half of the initial target, with neonatal deaths alone comprising the largest percentage of childhood deaths (40%).^{1,4} Throughout the country, the neonatal mortality ratio (NMR) has remained stable since the adoption of the MDGs in 2004, though no regional data within PNG is available.¹ Recent data published by UNICEF found an overall increase in neonatal mortality worldwide despite improvements in U5MR. Estimates

based on current data trends project that half of child deaths in the year 2030 will occur within the first 28 days of life.⁴ It is thought that many of the neonatal deaths in PNG are due to a lack of skilled birth attendants present at deliveries coupled with poor immediate newborn care for the 50-85% of deliveries that occur in rural areas.^{1,5}

The leading causes of neonatal deaths worldwide as well as in PNG remain birth asphyxia, premature delivery and low birth weight, and neonatal sepsis. Multiple interventions and recommendations pertaining to the management of a newborn in low-resource settings have demonstrated improved morbidity and mortality ratios in these populations.⁶⁻¹¹ However, basic newborn care services are not currently available in PNG.¹ Helping Babies Breathe (HBB) is a standardized neonatal resuscitation training program developed in the United States and endorsed by the American Academy of Pediatrics for use in low resource settings with high rates of neonatal morbidity and mortality. HBB has been well-documented to improve both neonatal mortality as well as the rate of fresh still births by reducing the number of asphyxia-related deaths.⁶⁻⁷ Early skin-to-skin care (SSC) and so-called “kangaroo care” have been shown to be an effective strategy not only to prevent hypothermia, but also to help stabilize infant heart and respiratory rates and promote early initiation of breastfeeding—essential for infants born either prematurely or with a low birth weight.⁸⁻¹⁰ In these settings, many neonatal infections start as umbilical cord infections, making it crucial that the cord is cut and fastened with a new blade and tie. Afterwards, either topical antiseptics or dry cord care should be utilized.¹¹ Delayed cord clamping can also reduce the likelihood of anemia and improve oxygenation in the infant.¹²

While the interventions described above have been shown to improve infant mortality in

other developing countries, it is unclear what inventions would be useful in PNG due to a lack of data (specifically regional or provincial information) regarding the current standard of care in PNG healthcare facilities as well as the traditional birthing practices in rural areas. The New Ireland Province (NIP), the northeastern-most province of PNG, is comprised of nine collections of islands and twenty-two distinct language and people groups. No estimates were available for the overall number of islands that belong to the NIP. 194,000 people live across the province's 3,600 square miles of land.¹³ The 104 bed provincial hospital, Kavieng General Hospital (located on the largest island, New Ireland), is the only location where an obstetrician and pediatrician are stationed within the entire NIP.¹⁴ Additional healthcare facilities in NIP (figure 1) include a district hospital on the Eastern side of NIP (staffed by a single general practitioner), health centers (staffed by registered nurses), and aid posts (staffed by community health workers).

Map of New Ireland Province Aid post Distribution 2011

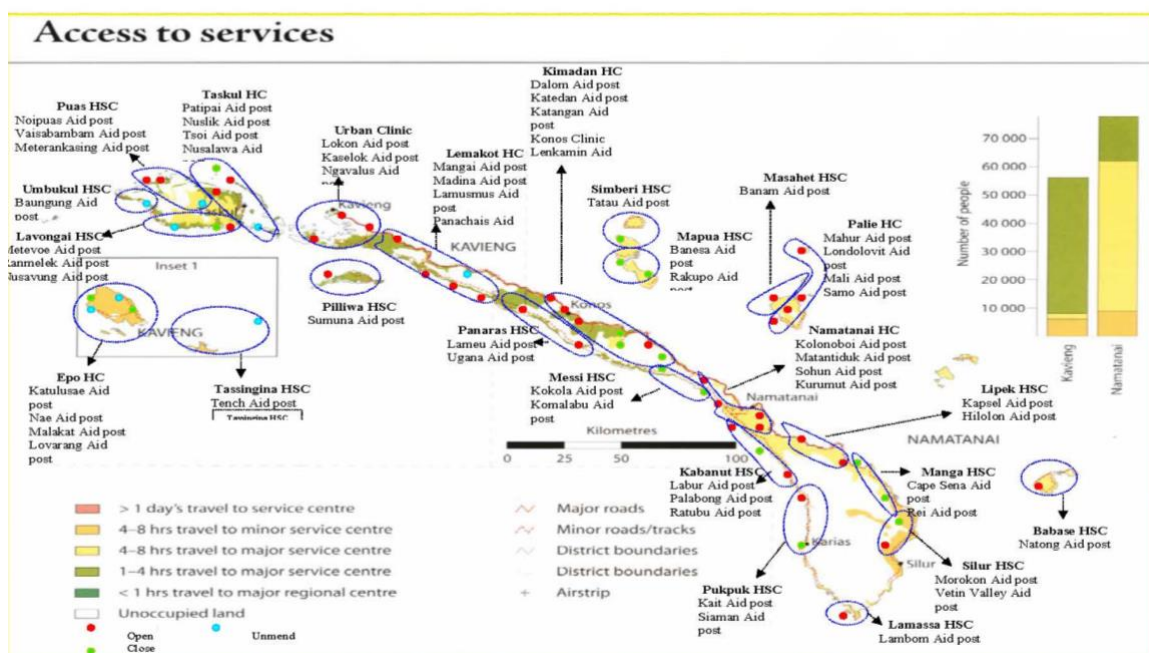


Figure 1: Map of healthcare facilities within the New Ireland Province. Permission for reprinting granted by Kavieng General Hospital.

The Tigak tribe is one of the 22 people groups native to the NIP with an estimated population of 15,000-20,000 spanning multiple small islands within Kavieng harbor as well as Kavieng town. Limanak (figure 2) is one of the Tigak islands (approximately 3.5 million square feet) located roughly 30 minutes from the hospital by outboard motor boat (with smooth seas). It is estimated that 250 Tigak live on Limanak Island without any immediate access to healthcare. Additionally, no information is currently published and available regarding traditional Tigak customs surrounding childbirth and newborn care.



Figure 2: Map of Papua New Guinea illustrating New Ireland Province (red), Kavieng (black), and Limanak Island (blue). Adapted from PAT, by I Macky, n.d., Retrieved March 2, 2018 from <http://ian.macky.net/pat/map/pg/pg.html>.

The overall goal of this project was twofold. First, to evaluate and compare existing birthing practices both at the regional hospital (Kavieng General Hospital) and among one rural people group (Tigak tribe from Limanak Island) in order to identify an appropriate intervention

that could ultimately reduce neonatal mortality. Secondly, to determine the feasibility and acceptability of providing standardized neonatal resuscitation training among rural delivery attendants in the Tigak region.

METHODS

Description of Current Birthing Practices in Papua New Guinea's New Ireland

Province

In order to establish a regional control population, the current standard of neonatal and obstetric care within one of PNG's provincial hospitals was assessed. After obtaining oral consent from each mother, thirty-five vaginal deliveries were observed and documented at Kavieng General Hospital in June 2015. In addition to demographic information, details of the delivery were recorded anonymously. Reported details included: maternal gravida and parity, underlying maternal health conditions, receipt of prenatal care, estimated gestational age, appearance of amniotic fluid, complications during delivery, length of third stage of labor, infant Apgar scores, resuscitation steps utilized, infant birth weight, umbilical cord care, routine newborn care provided, and infant outcomes.

Traditional birthing customs and practices occurring in one of the rural islands of the NIP (Limanak Island) were then described. In July 2015, oral consent was obtained prior to interviewing thirty-one women (with the aid of a translator) who had given birth on Limanak between 2010 and 2015. Recorded data was de-identified and included maternal gravida and parity, underlying maternal health conditions, receipt of prenatal care, estimated gestational age, reason for rural delivery, people present at the time of birth, utilization of hand hygiene, length of third stage of labor, location of the infant immediately following delivery, umbilical cord care, routine newborn care provided, and infant outcomes (appendix A). The two population data sets were then compared and analyzed for statistical significance using Fisher's exact test.

Assessment of Village Midwife Practices

Given that the majority of rural births occur in the presence of a traditional birth attendant (referred to as village midwives throughout this study), three village midwives from Limanak were interviewed after informed consent was obtained. Village midwives shared their years of experience, reason for becoming a midwife, previous training or education, estimated number of deliveries each year, ability to provide prenatal care, location of deliveries, timing of midwife arrival and length of stay after delivery, midwife preparation before birth, umbilical cord care, and routine infant care provided (appendix B). Additionally, village midwives were given case scenarios that included breech delivery, retained placenta, post-partum haemorrhage, and a nonvigorous infant and asked to describe their steps in management to assess baseline training.

Implementation of Neonatal Resuscitation and Newborn Care Training

During a subsequent trip to the NIP of PNG in 2018, seventeen Tigak women including seven village midwives from three Tigak villages (Limanak Island, Nusailas Island, and West Coast NIP) were trained in neonatal resuscitation and newborn care using the HBB curriculum. Five training sessions were held on Limanak Island and taught in Melanesian Pidgin (one of three official PNG languages). Class participants were asked to complete objective structured clinical examinations (OSCEs) before and after the course. All of the necessary supplies and equipment were provided at the start of each examination. Their action steps were recorded and compared pre and post training.

In an effort to provide a sustainable education program in northern PNG, one national nursing officer native to the NIP was identified to help teach village midwives. After

completing the provider course, this nurse received supplemental education and equipment in order to become a HBB master trainer. She then co-taught the village midwives how to perform neonatal resuscitation.

RESULTS

Population Demographics

Overall, the women who delivered at the hospital traveled between 0 and 100 km (figure 3) from their homes with an average distance of 22.3 km (SD 29.3 km) traveled via foot, bus, and boat. Limanak Island is located 12.5 km by boat from the hospital (with a typical travel time of 30 minutes via outboard motor boat and smooth seas). Mothers who delivered at the hospital were 25.9 years on average (range 17-39, SD 5.8) and those on the island were an average age of 26.5 years (range 17-39, SD 5.6, $p = 0.6713$) (figure 4). 40% of the women who delivered at the hospital were delivering their first child (average parity 1.7, range 0-7, SD 1.9), whereas the average parity for women on Limanak was 2.4 (range 0-8, SD 1.5, $p=0.1046$) with only 2 of the 31 women delivering their first child in the village (figure 5).



Figure 3: Map of New Ireland Province outlining in green a 100 km radius surrounding the hospital in Kavieng. Adapted from PAT, by I Macky, n.d., Retrieved March 2, 2018 from <http://ian.macky.net/pat/map/pg/pg.html>.

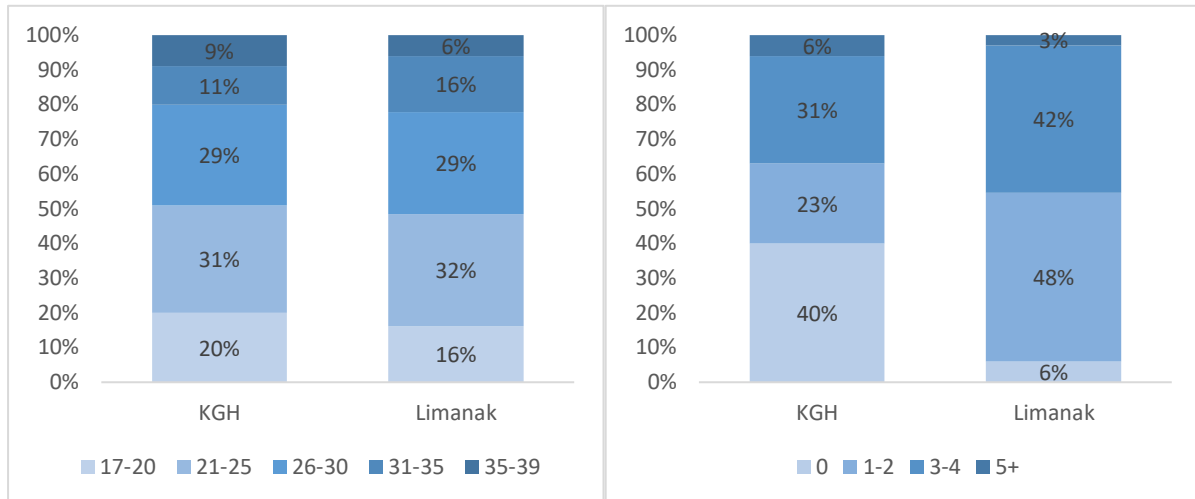


Figure 4 (left): Age distribution of mothers by location in the NIP of PNG. Figure 5 (right): Maternal parity by location in NIP, PNG.

Obstetric and Pediatric Standards of Care in Papua New Guinea’s New Ireland

Province

Women who present for prenatal care at the hospital or health center receive an evaluation of their weight, vital signs, fundal height, fetal heart rate, and fetal position at each visit. Women who have attended at least one prenatal visit are considered by PNG government to be “booked” which differs from “unbooked” women who did not receive any prenatal care. Additionally, women also receive a syphilis, HIV, and anemia screening once during their pregnancy or at the time of delivery. At Kavieng General Hospital, staff have access to gloves as well as sterile scissors and umbilical cord clamps used at every delivery. If a complication arises, the nurse midwives have access to IV fluids, oxytocin, magnesium sulfate, and antibiotics as well as suture materials, an operating room, and an obstetrician if needed.

Once born, infants were routinely dried, stimulated, and received SSC with their mother. Neither suction nor bag-valve-mask resuscitation equipment were assessed for function or easy accessibility before deliveries. Chlorohexidine antiseptic solution was applied to the

umbilical stump after it was clamped and cut with sterile materials. Prior to discharge from the hospital, infants received vitamin K, hepatitis B, and Bacille Calmette-Guerin (BCG) injections.

Traditional Birthing Practices on Limanak Island

Women who delivered on Limanak Island reported four primary reasons they did not give birth at the hospital (figure 6). 32% stated they did not have money to purchase “zoom” (outboard motor fuel), 29% reported the baby was born too quickly, 16% did not have an available boat and driver, and 13% felt the trip to the hospital was too inconvenient and chose to deliver on the island. The remaining 10% of women listed various other reasons including bad weather/rough seas as well as one woman who was sent home from the hospital. The majority of the deliveries on the island were attended by a village midwife (61%), though 23% of women were alone during their delivery, and 16% of the women had a female relative present without the assistance of a village midwife. Only one woman reported the use of hot water to clean her hands prior to delivery; the remaining 30 women denied the use of any hand hygiene.

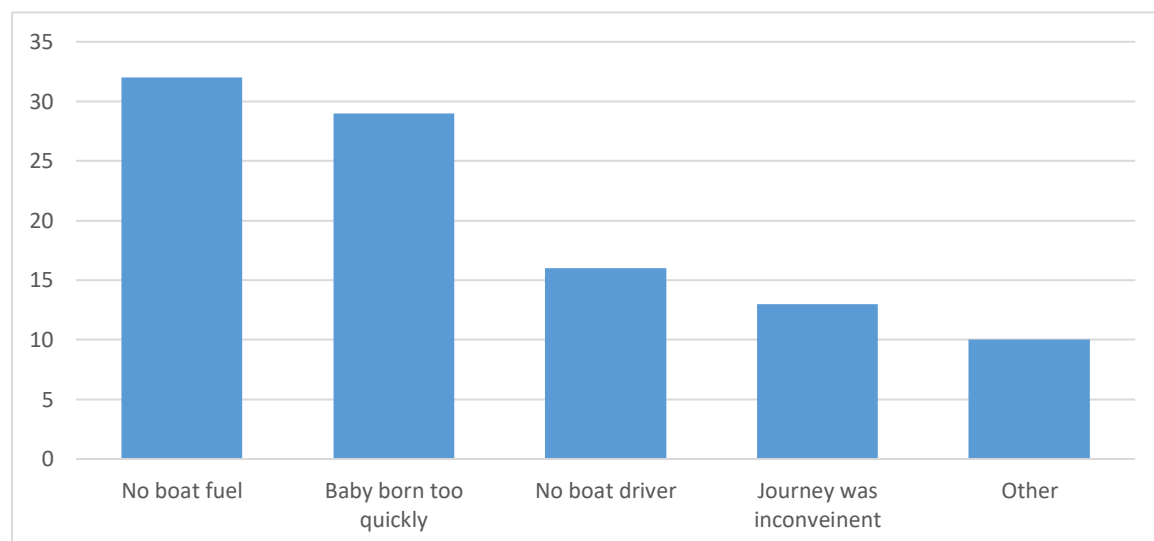


Figure 6: Graph of reported reasons for previous village delivery.

In the majority of cases, after the baby was delivered, the infant was set beside the mother either on a woven mat or cotton cloth without being dried or stimulated until the placenta was delivered (occurred during 83% of deliveries). This was reported both by Tigak mothers as well as village midwives to occur due to the traditional cultural belief that holding the baby before the entire delivery was complete would harm the infant's spirit. After the placenta was delivered, the baby was then held and dried before tying and cutting the umbilical cord with thread and a razor blade, respectively. 48% of the women stated they first cleaned an old razor blade (demonstrated to simply wipe the dirt off) prior to cutting the cord and the remaining 52% of women reported using a new razor blade to cut the cord. Over the course of the interviews, women also described wrapping the umbilical stump with a leaf (usually after it was passed through the fire), though data was not specifically gathered regarding the frequency of this practice.

Comparison of Hospital and Village Deliveries in New Ireland Province

Prior to their delivery, 91% of women who delivered at the hospital had received prenatal care at the hospital or health center (figure 7) while only 58% of the population from the island had prior prenatal care ($p = 0.0032$). Hand hygiene was utilized before all deliveries at the hospital, but only partially completed in 1 of 31 village deliveries ($p < 0.0001$). 94% of the infants born at the hospital were immediately dried and stimulated before receiving SSC with their mother, whereas only 13% of the infants on Limanak Island received similar care ($p < 0.0001$). Lastly, the umbilical cord was fastened and cut with clean material at all hospital deliveries and only 52% of village deliveries ($p < 0.0001$).

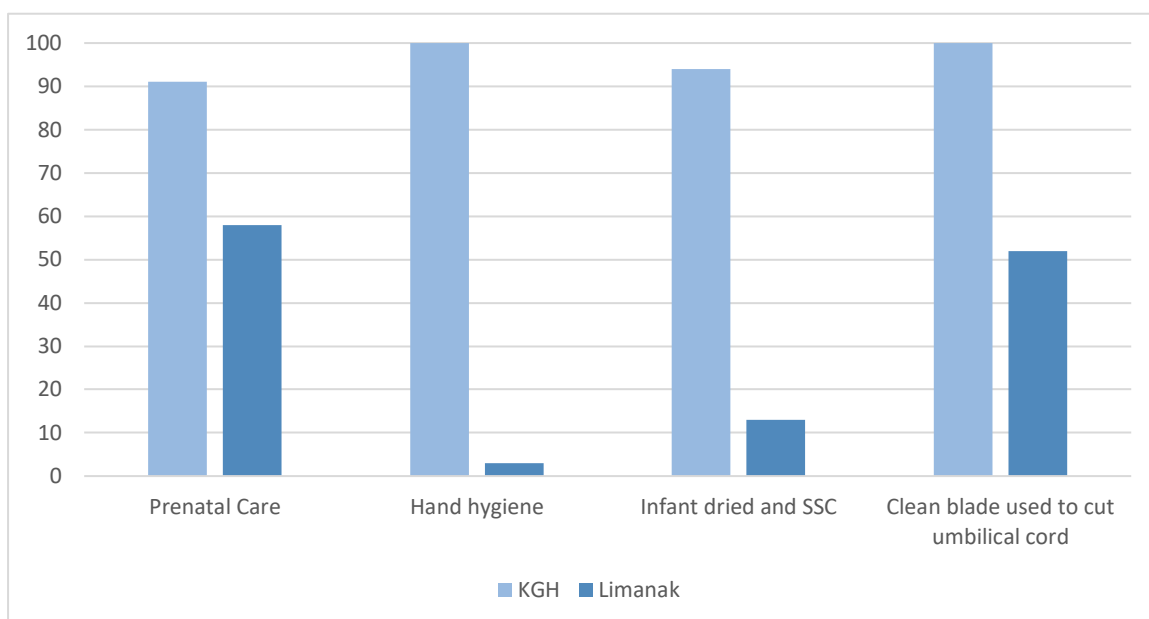


Figure 7: Obstetrical practices by location.

While 8.6% of the neonates born at the hospital and 22.6% of rural-born neonates died, this data was not found to be statistically significant ($p = 0.1705$). However, when comparing each individual population to the country's neonatal mortality ratio (NMR) for 2015 (figure 8), the hospital's rate of 8.6% was not statistically different ($p = 0.0594$) than PNG's reported 24 neonatal deaths per 1000 live births (CI 14.0-41.5), while the rural population rate of 22.6% was statistically significant ($p < 0.0001$).

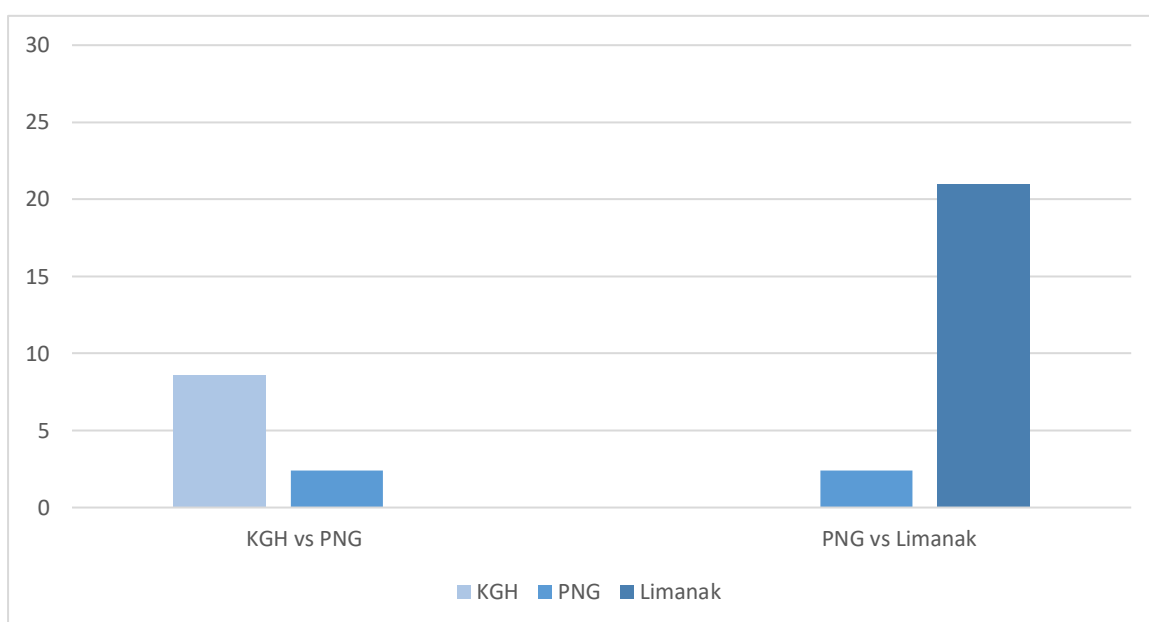


Figure 8: Neonatal mortality by location.

Village Midwife Education

The village midwives had a range of experience between 15 and 30 years (average 23 years). They stated their reason for delivering babies was due to a deep sense of responsibility to care for the other women in their tribe. One woman also recalled that she was chosen to help deliver infants after she had successfully delivered her own 8 children alone on the island. While none of the 3 women interviewed in 2015 had received any type of formal education, they reported learning how to deliver a baby by observing and working alongside another village midwife or by utilizing the pictures from an old Australian textbook written in English.

When the village midwives were called to attend a delivery, they first prepared by bathing themselves in stored rain water with soap if available. However, if there was not enough time to bathe, they would change into a clean shirt before attending the delivery. Once the infant was born, they laid it on a woven mat next to the mother and waited for the placenta to deliver before attending to the infant. If the infant was not crying, their management ranged from holding the baby upside down over fire or boiling water (using the smoke or steam to stimulate the baby to sneeze and clear the fluid) to applying a hot and ashy leaf to the infant's face as well as slapping the backside of the baby (usually when upside down) to try and stimulate the baby to cry.

Neonatal Resuscitation Education

During the pre-course OSCE, none of the seventeen participants attempted to prepare for the delivery by washing their hands or calling for help (figure 9). The women had never seen or used the resuscitation equipment (bag-valve-mask and bulb syringe) prior to the course;

thus, no one attempted to use the equipment on the non-breathing manikin. Rather, 73% of participants held the manikin upside-down and slapped it, another 20% held the upside-down manikin in the smoke over the fire attempting to clear residual amniotic fluid from the baby's airway, and finally 6% attempted mouth-to-mouth ventilation after stimulating breathing by rubbing the baby's back.

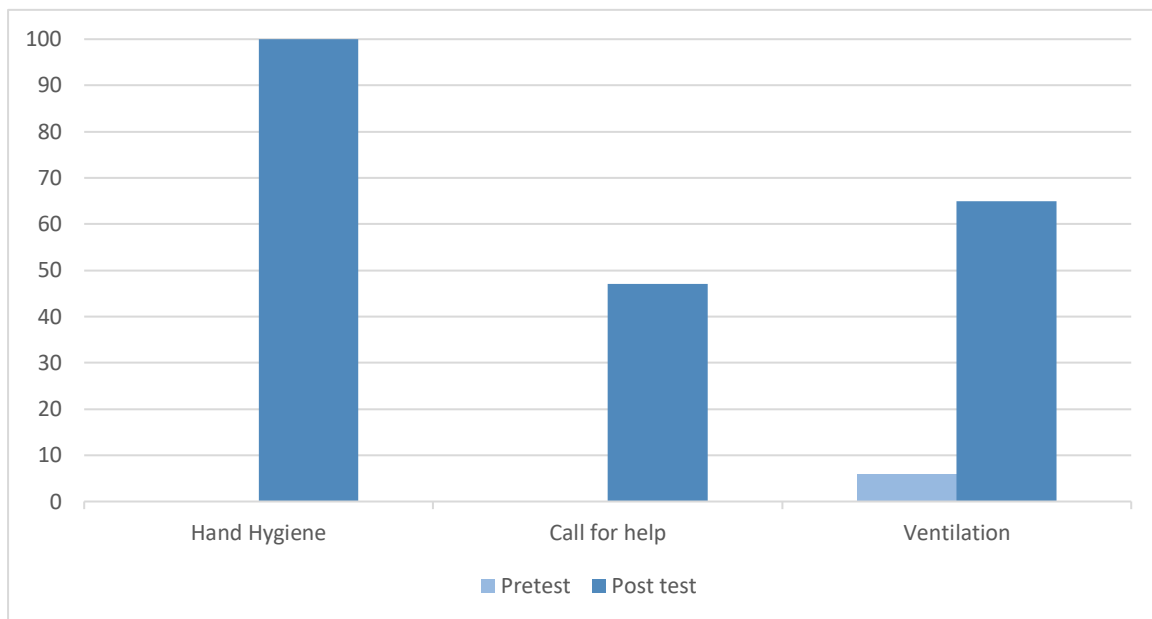


Figure 9: Pre and post course clinical examination results

Resuscitation training was presented utilizing the HBB pictorial flipchart and flowsheet (figure 10). After completing the pre-course OSCE on day 1, participants learned how to prepare for delivery by washing their hands (via a six-step process), identifying a clean delivery area for mother and baby, and gathering necessary supplies (hat, blankets, umbilical cord ties, new razor blade, bag-valve-mask, and bulb syringe). Each daily session lasted 3-4 hours and began with an action-based review of the previous material and concluded with a daily skills test. On the second day, the women learned how to perform routine newborn care for a vigorous infant (drying the baby immediately, checking for a regular breathing pattern, encouraging SSC and breastfeeding, and providing both delayed and hygienic umbilical cord

care). Participants learned on day 3 the initial management steps for a nonvigorous (not crying, not breathing regularly, and floppy or blue appearing) infant that included: drying and stimulating the baby immediately, checking for excess fluid blocking the airway (and suctioning if needed), and evaluating the infant's response to the care provided. If the initial management proved unsuccessful, the women learned how to provide effective positive pressure ventilation (PPV) utilizing the bag-valve-mask and watching for chest rise on the day 4.



Figure 10: Helping Babies Breathe classroom on Limanak Island (pictorial flowsheet and teaching manikin included).

After completing their resuscitation training, the participants returned the following day (session 5) to complete their post-course OSCE. All seventeen women prepared for delivery by correctly washing their hands as well as instructing the mother in the scenario how to properly wash her hands. 47% called for help by asking another woman for assistance. When the infant was delivered, 82% immediately dried and stimulated the baby to breathe. After recognizing the manikin was not breathing, 65% of the women were able to correctly use the

bag-valve-mask to provide effective PPV within the first minute after delivery (“the golden minute”) and another 29% attempted PPV either after the golden minute or without observing good chest rise (figure 9). If a participant did not pass the OSCE on the first attempt, they had additional time to strengthen their weaker skills and complete a repeat examination. All six women who required remediation successfully demonstrated their skills on their second exam.

CONCLUSIONS AND RECOMMENDATIONS

The results of this study demonstrate a large discrepancy of care within one region of PNG (the New Ireland Province) with a higher observed neonatal mortality rate for island deliveries. Given the geographic diversity of PNG partially outlined in this paper, it is not surprising that PNG continues to have high rates of rural deliveries. While 50-85% of the deliveries occur in rural areas, there are community-identified village midwives that attend most of these deliveries.^{1,5} This study demonstrates that implementation of a standardized neonatal resuscitation training program outlining routine newborn care and PPV is feasible and effective in this region despite high illiteracy rates and a lack of previous formal education.

While this study only demonstrates the immediate successes of implementing HBB training among village midwives, a 2016 study among Sudanese village midwives demonstrated adequate skills retention at one year post training using regular peer-based skills reviews.¹⁵ The registered nursing officer who completed the HBB training during this project can help facilitate skill checks and reviews among the village midwives and likely increase their post course retention rate. Throughout the study, the women from Limanak Island described various cultural practices that initially created barriers to proper newborn care; yet, when they received HBB training, they were successfully able to move beyond these customary barriers and incorporate new practices into their usual newborn care. This success and acceptability among participants is likely a result of the long-term relationships that were established with this people group over the three years this project was ongoing.

Moving forward, it would be helpful to further expand partnerships with local healthcare facilities and providers within PNG to train additional village midwives in HBB as well as other courses such as Helping Mother's Survive. Continuing to assess post-training retention rates and actual use in local practice would provide helpful information on the need for follow-up training. Lastly, it would be useful to conduct a new assessment of the neonatal mortality on Limanak Island 3-5 years after implementing HBB training.

LIST OF FIGURES

Figure 1: Map of available health services in the New Ireland Province	4
Figure 2: Map of Papua New Guinea	5
Figure 3: 100 km radius from Kavieng	10
Figure 4: Age distribution of mothers by location	11
Figure 5: Maternal parity by location	11
Figure 6: Reasons for village delivery	12
Figure 7: Obstetric practices by location	14
Figure 8: Neonatal Mortality by location	14
Figure 9: Pre and post course clinical examination results	16
Figure 10: Helping Babies Breathe classroom on Limanak Island	17

REFERENCES

1. *Summary Report for Papua New Guinea: Millennium Development Goals 2015*. PDF. National Capitol District, Papua New Guinea: Department of National Planning and Monitoring, 2015.
2. UNICEF Annual Report 2013-Papua New Guinea. (2014, July 3). Retrieved March 9, 2015.
3. United Nations. General Assembly. "United Nations Millennium Declaration." *General Assembly* 18 (2000).
4. UNICEF, WHO, World Bank Group, and United Nations. *Levels and Trends in Child Mortality 2017*. PDF. UNICEF, October 2017.
5. Queensland's Health. *The Health of Queensland's Papua New Guinean Population 2009*. PDF. Brisbane: State of Queensland, December 2011.
6. Msemo, Georgina, Augustine Massawe, Donan Mmbando, Neema Rusibamayila, Karim Manji, Hussein Lesio Kidanto, Damas Mwizamuholya, Prisca Ringia, Hege Langli Ersdal, and Jeffrey Perlman. "Newborn Mortality and Fresh Stillbirth Rates in Tanzania After Helping Babies Breathe Training" *Pediatrics* 131, no. 2 (2013). Accessed November 16, 2017. doi:10.1542/peds.2012-1795d.
7. Arabi, Ali M E, Salah A. Ibrahim, Abdel-Rahman Manar, Mohamed S. Abdalla, Sami E. Ahmed, Eugene P. Dempsey, and C. Anthony Ryan. "Perinatal outcomes following Helping Babies Breathe training and regular peer-peer skills practice among village midwives in Sudan." *Archives of Disease in Childhood* 103, no. 1 (2017): 24-27. doi:10.1136/archdischild-2017-312809.
8. Conde-Agudelo, A, and Diaz-Rossello, JL. *Kangaroo mother care to reduce morbidity and mortality in low birthweight infants (Review)*. PDF. John Wiley and Sons, Ltd, 2014.
9. Wariki WMV and Mori R. Interventions to prevent hypothermia at birth in preterm and/or low-birth-weight infants: RHL commentary (last revised: 1 June 2010). *The WHO Reproductive Health Library*; Geneva: World Health Organization.
10. Edmond K.M., "Delayed Breastfeeding Initiation Increases Risk of Neonatal Mortality." *Pediatrics* 117, no. 3 (2006). Accessed November 16, 2017. doi:10.1542/peds.2005-1496.
11. Karumbi, Jamlick, Mercy Mulaku, Jalemba Aluvaala, Mike English, and Newton Opiyo. "Topical umbilical cord care for prevention of infection and neonatal mortality." *The Pediatric infectious disease journal* 32, no. 1 (2013): 78.
12. McDonald, Susan J., Philippa Middleton, Therese Dowswell, and Peter S. Morris. "Effect of timing of umbilical cord clamping of term infants on maternal and neonatal outcomes." *Evidence-Based Child Health: A Cochrane Review Journal* 9, no. 2 (2014): 303-97. Accessed November 16, 2017. doi:10.1002/ebch.1971.
13. "About New Ireland." Australian Doctors International. Accessed March 09, 2018. <http://www adi.org.au/about-new-ireland/>.
14. "People Helping People." Kavieng Hospital Volunteers. Accessed November 16, 2017. <http://www.kavienghospitalvolunteers.org/>.
15. Arabi, Ali Me, Salah A. Ibrahim, Sami E. Ahmed, Finn Macginnea, Gavin Hawkes,

Eugene Dempsey, and C. Anthony Ryan. "Skills retention in Sudanese village midwives 1 year following Helping Babies Breathe training." *Archives of Disease in Childhood* 101, no. 5 (2016): 439-42. doi:10.1136/archdischild-2015-309190.

APPENDIX A: VILLAGE DELIVERY INTERVIEW

Person completing survey: *Circle one.*

Self/mother

Father/husband

Parent

Sister

Cousin

Child

Other_____

Age:

City/Town/Village:

Occupation:

Husbands occupation:

Number of pregnancies:

Number of live births:

Age of children:

Living? *Circle one.* **Age at death:**

Cause of death:

1.

Yes or No

2.

Yes or No

3.

Yes or No

4.

Yes or No

5.

Yes or No

Known health problems:

Did you receive antenatal care? *Circle one.* Yes or No **Where?**

What type of care did you receive? *Circle all that apply.*

Sonogram

Fetal Doppler

Fetal Position

Fundal height

Vitamins

Maternal vital signs

Other:_____

Estimated gestational age at the time of delivery?

Why did you have a village delivery?

Who was present at the birth?

Were they trained to deliver babies? *Circle one.*

1.

Yes or No

2.

Yes or No

3.

Yes or No

Did you or they wash their hands?

When?

What was used?

What position did you give birth in? *Circle one.*

Laying Down

Standing

Sitting

Squatting

Other_____

What material did you give birth on? *Circle one.*

Dirt

Woven mat

Cloth

Plastic tarp

Other_____

What position was the baby in when it was delivered? *Circle one.*

Head first, face down

Head first, face up

Feet or bottom first

Was the placenta delivered within 30 min of the baby's birth? *Circle one.* Yes or No
If not, what happened?

Did you experience prolonged bleeding? *Circle one.* Yes or No
If so, what happened?

When was the umbilical cord tied and cut? *Circle one.*

Immediately 1-2 minutes Pulsation stopped
Placenta delivered Other _____

What was used to cut and tie the cord?

When was the baby dried and wrapped?

In what?

Where was the baby placed immediately after birth?

How much did the baby weigh at birth?

Did the baby breastfeed? *Circle one.*

Yes or No

When did you begin breastfeeding? *Circle one.*

A few minutes

A few hours

A few days

How long did you exclusively breastfeed?

When did you fully wean the baby?

Please only answer the following questions if the mother passed away in childbirth.

How did she die? What do you think caused her death?

What happened leading up to her death?

Did the baby survive? Who cares for the baby?

APPENDIX B: VILLAGE MIDWIFE INTERVIEW

Age: City/Town/Village: Compensation per birth:
How long have you been a midwife?

Why did you become a midwife?

What type of training did you receive? How long? Where?

How many babies do you deliver per year?

Do you administer prenatal care? *Circle one.* Yes or No

What type of antenatal care do you provide? *Circle all that apply.*

Sonogram Fetal Doppler (heartbeat) Fundal Height

Vitamins Maternal vital signs

Other: _____

Where do you work? *Circle one.*

Mothers come to me I go to the mothers Both

When do you or they arrive for a birth?

How long do you or they stay after the baby is born?

Do you wash your hands? When? What do you use?

Do you check the mother while in labor? *Circle one.* Yes or No

How do you check the mother? What are you checking for?

What positions do you encourage mothers to give birth in? *Circle all that apply.*

Laying Down Standing Sitting

Squatting Other _____

What material does the mother give birth on? *Circle one.*

Dirt Woven mat Cloth

Plastic tarp Other _____

What do you do if the baby is not head first?

What do you do if the placenta is not delivered? How long do you wait?

What do you do if the mother is continuously bleeding?

When do you cut and tie the umbilical? *Circle one.*

Immediately 1-2 minutes Pulsation stopped

Placenta delivered Other _____

What do you use to cut and tie the cord?

What do you do if the baby is not crying or breathing?

When do you dry and wrap the baby?

In what?

Where do you place the baby immediately after birth?

Do you weigh the babies? *Circle one.* Yes or No

When?

Do you encourage the mothers to breastfeed the baby? *Circle one.* Yes or No

When do you encourage mothers to start breastfeeding after birth? *Circle one.*

Minutes Hours Days

How long do you encourage mothers to keep breastfeeding?

VITAE

Kendra Kelly (October 26th 1994-present) is a candidate for M.D. with Distinction in Global Health at the University of Texas Southwestern Medical Center. Upon graduation, she will begin her pediatric training at the University of Minnesota with a long-term goal of becoming a neonatologist and establishing a pediatric residency program in a developing country.

Kendra was born and raised in Texas and discovered her interest in global health during a medical mission trip to Lima, Peru in 2014. Since her first trip, Kendra has continued to work in international healthcare by returning to Peru as well as traveling to Papua New Guinea and Zimbabwe. Outside of medicine, Kendra enjoys salsa dancing, spoken word poetry, crocheting, and kickboxing.

Permanent Address:
122 Magnolia Lane
Conroe, TX 77304

Permanent email:
kendrakelly14@gmail.com