



May 2013

A Unique First-Aid Device for Obstetric Hemorrhage and Hypovolemic Shock: Policy Implications for Implementing the Non-Pneumatic Anti-Shock Garment

Introduction

Of the 287,000 maternal deaths occurring annually, over 99% happen in low-income countries.¹ Obstetric hemorrhage (OH), which includes hemorrhage during pregnancy, childbirth, or after delivery, is the leading cause of maternal mortality, accounting for one-quarter of global maternal deaths.² While great progress is being made to reduce maternal mortality globally, OH remains a leading killer of women of reproductive age.

Hypovolemic shock secondary to obstetric hemorrhage can lead to multiple organ failure and maternal death; preventing and reversing shock are primary goals of obstetric hemorrhage management.

A significant number of maternal morbidities and mortalities related to postpartum hemorrhage (PPH) can be prevented with the implementation of active management of the third stage of labor (AMSTL), particularly the administration of uterotonics, such as injectable oxytocin or oral misoprostol within 5 minutes of delivery.^{2,3,4} Despite administration of AMSTL/prophylactic uterotonics, women still experience uterine atony. Additionally, many etiologies of OH such as ruptured uterus, genital lacerations, and ectopic pregnancy do not respond to uterotonics for either prevention or treatment.⁵

Women Die From Delays

Proper treatment of women experiencing OH and shock may be delayed by several factors. Delays in recognizing obstetric complications, deciding to seek care, reaching a care facility, and receiving rapid access to blood or surgery once in the facility, can all result in preventable maternal deaths.⁶ In order to achieve the UN's Millennium Development Goal 5 (a 75% reduction in maternal mortality by 2015), it is imperative to

implement strategies and technologies designed to overcome delays in reaching and receiving definitive obstetric care.

The Non-pneumatic Anti-Shock Garment (NASG) is a unique and simple first-aid device that has been proven to overcome delays that result in preventable maternal mortality, allowing women to survive hemorrhage and shock.

This policy brief will explore how governments, policy makers, NGOs, and professional associations can implement the NASG into health systems in order to decrease maternal mortality.

The NASG

The NASG is a unique first aid tool for shock related to OH. It is made of a stretchable compression material called Neoprene. The NASG is comprised of nine articulated segments that are wrapped sequentially around the legs, pelvis and abdomen and closed with Velcro. A foam ball over the abdomen provides additional compression. The NASG works by applying circumferential counter pressure, decreasing blood flow to the compressed area (abdomen, pelvis and lower extremities), and enhancing blood flow to the heart, lungs, and brain.⁷ When blood is increased to these core organs, shock symptoms are reversed. The NASG stabilizes the woman to survive transport to a facility where she can receive proper emergency treatment. The NASG can be applied quickly and easily in less than 2 minutes by virtually anyone, including those with no medical training. The NASG can also be left in place while performing procedures to treat OH such as suturing of lacerations and surgery. However, while anyone can place an NASG, only a skilled clinician can treat for shock and remove the NASG.

Results of NASG Studies

In recent NASG studies in Egypt and Nigeria that included over 1,800 women, researchers noted significant reductions in measured blood loss, emergency hysterectomies, and maternal morbidities and mortalities related to OH and shock in tertiary facilities.^{5,8,9,10,11,12}

NASG application was also associated with more rapid recovery from shock.^{13,14} The NASG has been shown to



help overcome life-threatening delays; it buys precious time to reach facilities capable of providing definitive care and directly offsets consequences of delays.¹³ Results from a randomized, controlled cluster trial examining the benefits of NASG application at primary care levels in Zimbabwe and Zambia show similar results to the tertiary care facility studies, a 50% reduction in maternal deaths. These results will be released in 2013.

The NASG Can Be Reused and Is Extremely Cost Effective

The NASG can be washed, decontaminated, and reused at least 40 times. A cost-analysis of intervention trials in Egypt and Nigeria found that NASG use for treatment and management of severe shock resulted in substantial savings in medical costs, including reduced blood transfusion, fewer emergency hysterectomies, fewer units of blood needed for transfusions, and fewer mortalities and disabilities.¹⁵

The NASG is Recommended in Global Safe Motherhood Organizations' Guidelines

Three of the leading maternal health organizations, The World Health Organization (WHO), International Federation of Gynecology and Obstetrics (FIGO), and the Global Library of Women's Medicine (GLOWM) all recommend the NASG as a device to stabilize women experiencing hypovolemic shock secondary to PPH.

- In the 2012 *Guidelines of Best Practices For The Prevention and Treatment of Postpartum Hemorrhage in Low-resource Settings*, FIGO recommends use of the NASG as a potentially life-saving tool to manage hypovolemic shock and survive delays.³
- The NASG is included in 2012 GLOWM's *Guidelines for Immediate Action in Treating Postpartum Hemorrhage*, which recommends placing the NASG to keep a woman with PPH stable during transport to a facility capable of providing definitive care.¹⁶
- In 2012, the NASG was included in the WHO *Recommendations for the Prevention and Treatment of Postpartum Haemorrhage*. The WHO recommends the NASG as a temporizing measure until appropriate care is available.²
- Further support for implementation of the NASG comes from *WHO Recommendations on the Prevention and Treatment of Postpartum Haemorrhage: Highlights and Key Messages from New 2012 Global Recommendations*. The WHO advises the following actions for policy and programming:
 - a) that national guidelines be reviewed to ensure that NASGs are included,
 - b) that training curricula are reviewed to ensure providers are trained to use NASGs, and
 - c) that programs procure NASGs and adapt them for low-resource settings as needed.¹⁷

Key Elements Necessary to Expand Use of the NASG :

1. **Identifying champions to implement and advocate for NASG use**
2. **Examining existing service models to determine appropriate levels of NASG introduction in specific contexts**
3. **Integrating the NASG into national standards of care for complications of pregnancy**
4. **Strengthening referral systems to ensure that women in shock reach Comprehensive Emergency Obstetric Care (CEmOC) facilities**
5. **Incorporating the NASG into pre-service and in-service training of skilled attendants, ambulance drivers, EMTs, village health workers, and others who care for or transport women with OH**

6. **Ensuring accessibility and developing a system of exchange and return for the NASG between levels of care**
7. **Creating demand to decrease costs and enhance use across the country**

1. Identifying Champions to Implement and Advocate for NASG Use

Uptake and implementation of new technologies can prove challenging without the support of influential and trusted advocates within a community, facility, professional association, or country. While a strong evidence base may support the necessity for an innovation, evidence alone will not ensure diffusion. The role of champions in advocating for and implementing an innovative technology or approach is critical to facilitating acceptance within a community or context.¹⁸ Identifying appropriate and influential community members, leaders, or organizations to act as “change agents” or “innovators,” allows the technology to gain momentum.

Champions may come from a variety of roles within the health, gender, and development sectors and these advocates can serve to support NASG uptake on multiple levels. Champions from the leadership and membership of professional associations, such as FIGO and the International Confederation of Midwives, will help to advance awareness and utilization of the NASG within the maternal health community, specifically among the midwives, nurses, anesthesiologists, and obstetrician/gynecologists who treat women suffering from OH and shock. Champions from the donor community will help to garner financial support and target resources to increase access to the NASG. Policy champions will ensure that other policy makers are aware of the positive attributes of the NASG, and why NASG use will reduce maternal mortality from OH. There is room for a wide range of champions willing to voice their support to save women’s lives with the NASG.

The examples in the box on the right from Nigeria demonstrate that champions come from a variety of sources and play a variety of roles. The NASG was introduced in Nigeria as a research project from 2004-2007. Between 2007-2013, Pathfinder International conducted a Continuum of Care for PPH project that included the NASG. The NASG has now been taken up in states outside of those where the research was conducted or where Pathfinder was working. These are just some examples of how widespread NASG use is in Nigeria, due to actions of champions.

1. Professor Oladosu Ojengbede, Director of The Center for Population and Reproductive Health (CPRH) at the University of Ibadan, was the lead Nigerian researcher on early NASG studies. A consultant obstetrician/ gynecologist, professor, and an indefatigable advocate for women’s health, Prof. Ojengbede is the perfect NASG champion. He is widely known throughout Nigeria and has used his reputation as a platform to increase NASG awareness. His advocacy outreach includes: the National Nursing and Midwifery Council, the Schools of Health Technologists, the National Reproductive Health Working Group, the National Committee of Teaching Hospitals, the Society of Obstetricians and Gynecologists of Nigeria, the Federal Ministry of Health, and the National Council of Health. Prof. Ojengbede has also ensured that the NASG has been presented at the annual Society of Obstetricians and Gynecologists conference annually since 2004. Along with his team, he has trained providers in 22 of Nigeria’s 36 states, as well as in Zambia, Zimbabwe, Ethiopia, South Sudan, and Liberia. Due to his consistent and spirited advocacy, the NASG is now being widely used for OH and shock management throughout Nigeria.

2. In 2006, Nigeria accidentally acquired an NASG champion. While visiting an NASG project hospital, a UNFPA State Reproductive Health Coordinator collapsed due to a ruptured ectopic pregnancy. She was placed in the NASG, taken to theatre, and recovered. Based on her firsthand experience, she has advocated for the NASG as first aid for OH and shock. As a result of her support, the UNFPA office in Nigeria has supported expansion of NASG projects throughout Nigeria.

3. As the Honorable Commissioner and Head of the Ministry of Economic Planning and Budget (MEPB), Professor Chinyere Okunna of Anambra State, Nigeria has proven to be an enthusiastic champion for the NASG. Due to Prof. Okunna’s advocacy, the Anambra State Government has funded the purchase of 221 NASGs for distribution throughout primary care facilities, public hospitals/secondary care facilities, and private/mission facilities.

2. Examining Existing Service Models to Determine Appropriate Levels of NASG Use in Specific Contexts

In order to determine the most efficient and cost-effective levels of the health care system to utilize the NASG, it is necessary to first identify the context where most births occur and to understand how the health system functions. For example, if a majority of births take place in tertiary care facilities, it may only be necessary to use the NASG at those facilities. If most births occur at a lower level, these facilities may be the most logical implementation target. It is important to note that, regardless of the level implementing the NASG, it must always be removed by a trained health care professional (doctor, midwife or nurse) at a tertiary facility, and only after the patient has received definitive care and has stabilized.

In Ethiopia, in 2011 the Clinton Health Access Initiative (CHAI) introduced the NASG in Oromia and Tigray as a pilot project. Their first step was to train staff in 9 referral hospitals how to incorporate NASGs into their shock and hemorrhage protocols. Next they trained staff at 10 health centers how to apply the NASG to hemorrhaging mothers and to refer patients to those 9 hospitals for definitive management.

Based on the results seen in these pilot sites, the regional health bureaus decided to scale up to other health facilities, and the NASG was implemented in 211 health centers and all 16 hospitals in Tigray and in 450 health centers and 43 hospitals in Oromia. To address all referrals from these health centers the scale-up also included training staff at some referral hospitals in other regions, as well as in federal hospitals in the capital city, Addis Ababa, resulting in NASG use in 7 regions of Ethiopia.¹⁹

In places where the NASG has never been used before, it must always be introduced first at the tertiary level. This serves to foster a supportive environment within the medical community to recognize the NASG as a critical tool to overcome delays. Most importantly, providers at the referral level must know how to manage women in the NASG before women begin arriving from lower levels wearing NASGs. Furthermore, acceptance in higher-level facilities allows for diffusion of standardized practices and procedures to lower level facilities.

At the primary care level, medical staff and skilled birth attendants involved in diagnosis and treatment of OH and shock should be proficient in the proper application of

the NASG. Awareness of the NASG as a unique first-aid device with which to stabilize patients within the facility or while awaiting transport to a referral facility provides increased ability to stabilize women in shock in primary care settings.

The World Health Organization recommends procuring NASGs and adapting them to low-resource settings as needed.¹⁷

However, many births may occur outside of a facility setting, and the NASG may be introduced at the community level. Training on NASG application at the community level offers traditional birth attendants and community health workers who may lack skills or resources the opportunity to effectively provide first-aid for OH and shock. Anyone who can be trained to recognize the signs of shock can also learn to apply the NASG.

In Tamil Nadu, India, ambulances are equipped with NASGs, and the drivers are trained to apply them. These ambulances transfer women to hospitals where the obstetrician/gynecologists are already familiar with the NASG for management of OH and shock and can provide continued care while the NASG is in place.

NASG use can also be incorporated for births occurring in the private sector. As in other settings, it is necessary to start training at the highest level, where patients with complications are sent, and work down to the level where most deliveries occur. Involvement of midwifery and medical professional associations is key to successful introduction of the NASG within the private sector.

3. Integrating the NASG into National Standards of Care for Complications of Pregnancy

In 2013 Niger's Ministry of Health will begin implementing the NASG as part of their "Initiative to Prevent and Treat PPH", with technical and financial assistance from the NGO HDI International and UNFPA. Niger plans to introduce the NASG nation-wide at all levels where women give birth, as soon as funding can be mobilized, so women in shock can be safely transported to higher level facilities for definitive care.

The World Health Organization recommends that national PPH guidelines be reviewed to ensure that NASGs are included.¹⁷

In April 2013 the Zambian National NASG Cluster Trial Results Meeting was held in Lusaka to disseminate the results of the randomized cluster trial of the NASG at PHC level. The First Lady, Dr. Christine Kaseba-Sata, and both the Minister and the Permanent Secretary of the Ministry of Community Development, Mother and Child Health committed to integrate the NASG into national guidelines and to scale up NASG use throughout the nation.

Integrating the NASG as a first-aid tool into national standards of care is crucial to support existing safe motherhood efforts, as the NASG uniquely provides an innovative, simple, efficacious, and cost-effective way to overcome delays. Standardization and implementation of emergency obstetric care protocols, including NASG use, is necessary to ensure that all women experiencing OH and shock have access to life-saving procedures. The NASG does not replace definitive care; it buys time and provides additional support for standard protocols in the management of hypovolemic shock and OH.

In Nigeria, the NASG has been integrated into the National Midwives Service Scheme, which trained and deployed 4,000 midwives to rural primary health care centers across the country. Midwives were trained to use the NASG as part of the essential Life Saving Skills for EmONC curriculum. Through training and practice for proficiency, midwives now have an increased ability to manage OH and shock, thus increasing a mother's chances of survival.

In Tamil Nadu, India, the Health Secretary has offered government support to expand training from the Pathfinder's Continuum of Care for PPH to additional health providers throughout the state, which includes integrating the NASG into standards of care.

4. Strengthening Referral Systems to Ensure that Women in Shock Reach CEmOC Facilities

National policies to reduce maternal morbidity and mortality need to strengthen referral systems and eliminate barriers to care. This helps to ensure that women with life-threatening complications reach facilities able to provide definitive treatment. The NASG is unique, as it is the only technology available to keep the woman's core organs oxygenated with blood while she is being transported to a tertiary level facility where life-saving blood transfusions and surgery are available.

Deterrents such as financial constraints and lack of transportation may severely impact a woman's ability to reach a facility capable of providing CEmOC.^{20,21} For example, in large urban settings, a woman may "bounce" from one hospital to another seeking care. At the first facility she may be told they lack personnel because of strikes; the next hospital may lack equipment or supplies; another has a long wait for surgery or no blood available



for transfusion. As she travels from hospital to hospital her condition worsens. Lack of stabilizing tools and defined referral systems, coupled with delays, may further exacerbate life-threatening maternal complications.¹³

Results from studies in Egypt and Nigeria indicate that NASG use at the referral hospital can stabilize women suffering from hypovolemic shock and obstetric hemorrhage, greatly enhancing the chance of survival during delays in obtaining treatment.^{11,13}

Integrating the NASG at the primary care level strengthens the referral process by initiating a continuum of care to be sustained at the secondary or tertiary care level, decreasing the likelihood of maternal death from hypovolemic shock. The NASG is easiest to implement in a closed referral system, with lower level facilities referring to a limited set of referral hospitals. All referral hospitals that receive patients transferred in the NASG must be trained in how to manage patients in the NASG and in safe NASG removal.

In Zambia and Zimbabwe, in a cluster-randomized trial, the NASG was placed at primary health care clinics (PHCs), where women initially access care and midwives attend normal deliveries. The NASG was integrated into the PHCs' referral protocols. All PHCs referred to specific referral hospitals that had been previously trained on the use of the NASG. Results indicated improved maternal outcomes.

5. Incorporating the NASG into Pre-Service and In-service Training of Skilled Attendants, Ambulance Drivers, EMTs, and Others Who Care for or Transport Women with OH and Shock

Incorporating the NASG into emergency response to life-threatening hemorrhage is most easily accomplished if new practitioners learn to apply it as part of their pre-service training.

Pre-service: The NASG has been successfully incorporated into the national pre-service curriculum of midwifery training through the Nursing and Midwifery Council of Nigeria, and the Federal Ministry of Health in collaboration with Pathfinder International. The Council provided each midwifery school with one NASG along with the recommendation that state governments purchase more NASGs. Monitoring activities of all 88 midwifery schools in the country found that all students who had been assessed were proficient in the proper application and removal of the NASG.

Pre-service: In Zimbabwe, by the end of the NASG RCT at PHC levels, medical school curricula included the NASG in the module on emergency obstetric response.

The World Health Organization recommends that training curricula be reviewed to ensure that service providers are trained to use the NASG.¹⁷

In-service: In September 2012, members of the Bolivian Society of Gynecology and Obstetrics, Santa Cruz, a professional association, invited the UCSF Safe Motherhood Program to attend their annual conference and train providers on the NASG. This led to cascade training that is currently ongoing twice a month for local providers in Bolivia. By April 2013, 360 providers had been trained.

In-service: During clinical trials in Zimbabwe and Zambia, continued training, supportive supervision, mentorship systems, and job aids such as posters reminded care providers of proper NASG use.

Any emergency response behavior, such as caring for a woman who is dying from hemorrhage, must be

practiced. NASG application training is very simple; anyone can be trained in less than one hour. However, as an emergency response, it is important that health care providers, ambulance drivers, and others who might apply the NASG become proficient through practice. The most effective way to become proficient is to learn to place the NASG as part of pre- and in-service training and through practice and drills.

In low-volume settings, drills involving practice placing the NASG are critical to help health providers maintain their skills.



6. Ensuring Accessibility and Developing a System of Exchange and Return for the NASG Between Levels of Care

The NASG saves mother's lives, thus providing a significant return on investment due to decreased medical costs and increased productivity among women of reproductive age. However, challenges to implementation across a region or country may exist. If NASGs are used outside of tertiary facilities, it is necessary to develop a system of NASG exchange and return in order to ensure consistent accessibility. Logistical issues should be examined and protocols/procedures developed that make sense in a particular context, in order to provide a simple system appropriate to the implementing health system.

In Zambia, a system of exchange and return was developed whereby the nurse or midwife accompanying a patient during transport from a primary health clinic (PHC) to the referral hospital would retrieve a clean NASG from the referral hospital and return it to the PHC. This protocol ensured that PHCs always had access to the NASG for the next patient who might need it.

7. Creating Demand to Decrease Costs and Enhance Use Across the Country

In-country advocacy for integration of the NASG into standard protocols by Ministries of Health and midwives' or medical associations, combined with advocacy campaigns to increase awareness of the NASG as a life saving device, may serve to increase demand for the NASG. Increased demand leads both to lower purchase costs and enhanced training opportunities. Cost sharing between NGOs and Ministries of Health and/or funding through outside organizations may also help to decrease costs and increase access to the NASG.

In India by 2012, Pathfinder International had distributed 2,043 NASGs in Bihar, Rajasthan, Maharashtra, Tamil Nadu, Assam, and Orissa states.

Cost sharing between the State Government in Tamil Nadu and Pathfinder International has greatly increased access to the NASG. Pathfinder donated 1,200 NASGs while the State Government approved exemption from import duty and paid 10% of overall duty costs.

As a result of Pathfinder's advocacy work in Nigeria, the UNFPA has supported the scale up of PPH interventions in Sokoto and Kebbi states by procuring NASGs and funding provider training. State governments in Lagos, Kano, and Katsina have provided funding to scale up PPH interventions to cover 57 sites and facilities. In Lagos, the government plans to purchase the NASG and conduct trainings and supervision to ensure proficiency. The Ministry of Women's Affairs in Nigeria has collaborated with Pathfinder to support efforts aimed at reducing PPH. Utilizing government funds, the Ministry purchased and distributed the NASG to secondary health facilities in 12 states, with plans to distribute the NASG in the remaining 24 states.

NASGs are currently available from Blue Fuzion Group (NASG@bfgroup.asia) and from Maternova (orders@Maternova.net). Prices range from \$60 to \$100 USD per garment depending on how many are ordered. A U.S. distributor, Stork Medical Group, sells NASGs for \$295 per garment (www.storkmedical.com).

The NASG is available in sizes small, medium, and large. Recommended sizing is based on the average height and weight of women in the country in which the



NASG is being used. In order to standardize practice, it is recommended that only one size be used throughout a country.

Conclusions

Safe Motherhood is a basic human right. The NASG is a critical addition to the toolkit used to reduce maternal mortality. Integration of the NASG into current emergency obstetric care training, protocols, and practice is a vital step towards ensuring that childbirth is safe and healthy for all women. The NASG is a unique, cost effective first-aid device that is efficacious in helping women to survive delays that lead to preventable maternal death. As with any new technology, there are challenges to implementation. These challenges can be met through a number of measures including: identification of champions who will advocate for and implement NASG use, examination of service models to assess appropriate levels of introduction, incorporating the NASG into standards of care (protocols/guidelines), strengthening referral systems to ensure that women reach definitive care facilities, adapting in-service and pre-service education to include the NASG in EmONC training, improving accessibility, designing a plan for handling logistics of NASG exchange and return, and creating demand for the NASG to decrease costs and expand use. These actions will more rapidly enable the NASG to be adopted and begin reducing maternal mortality globally.

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Acknowledgements

Special thanks to the following for describing their NASG programs: Professor Oladosu Ojengbede of the Center for Population and Reproductive Health at the University of Ibadan, Dr. Farouk Jega, Dr. Sudhir Maknikar and Dr. Subramonia Iyer of Pathfinder International, Professor Chinyere Okunna of the Ministry of Economic Planning and Budget in Anambra State, Dr. Anders Seim of HDI International and Dr. Carlos Futchner of the Bolivian Society of Gynecology and Obstetrics, Santa Cruz Affiliate.

This policy brief has been prepared by Professor Suellen Miller, Elizabeth Butrick MPH/MSW and Katie Giessler MPH for Safe Motherhood Program at the Bixby Center for Global Reproductive Health at the University of California, San Francisco. Additional thanks to Jillian Geissler for her contributions and to Nicholas Hu for designing the layout.

