



# THE NON-PNEUMATIC ANTI-SHOCK GARMENT (NASG):

*Saving Mother's Lives Through Innovation in Timor-Leste*

*Health Improvement Project (HIP)*

*Timor-Leste*

*John Snow, Inc. (JSI)*

*44 Farnsworth Street*

*Boston, MA 02210*

*[www.jsi.com](http://www.jsi.com)*

---

*November 2015*

---

# Table of Contents

<i>page</i> <b>3</b>	<i>page</i> <b>5</b>	<i>page</i> <b>12</b>	<i>page</i> <b>23</b>	<i>page</i> <b>33</b>
<i>Introduction</i>	<i>Background</i>	<i>Intervention</i>	<i>Results</i>	<i>Summary</i>

---

---

# INTRODUCTION

*Maternal mortality worldwide remains unacceptably high, with approximately 800 women dying every day from largely preventable causes related to pregnancy and childbirth.<sup>1</sup>*

The well-being of the mother is an important predictor of the health of her children and family. Investing in women's health - including ensuring women have safe and healthy pregnancies, deliveries, and post-partum periods - contribute not only to improved household health outcomes but also advance social and political development for the country.<sup>2</sup>

Timor-Leste suffers from one of the highest maternal mortality rates in the region. Despite progress made in the recent decade, the country still suffers from limited resources and infrastructure to support basic health services.


In order to address high maternal death rates, the **Maternal Child Health (MCH) Department** at the **Ministry of Health (MOH)** in Timor-Leste initiated several interventions to improve health outcomes at delivery.

As part of initiatives to prevent and manage post-partum hemorrhage (PPH), the MOH recently introduced the **Non-Pneumatic Anti Shock Garment (NASG)**, a breakthrough innovation designed to slow bleeding and surmount delays in reaching and receiving care.

This intervention is being implemented with technical assistance from the **Health Improvement Project (HIP)**, managed by **John Snow, Inc. (JSI)** in collaboration with the MOH.

The following document outlines the context, intervention approach, and results of efforts to address delays associated with obstetric hemorrhage in order to contribute to improved maternal health outcomes in Timor-Leste.





Twenty-six year old Martinha\* had a normal delivery for her fourth child at Comoro Community Health Center (CHC). Two hours after her delivery, she started to bleed severely due to a uterine atony and began going into shock.

## MARTINHA'S STORY

The midwife applied NASG immediately due to the large amount of blood loss and transferred Martinha to Hospital Nacional Guido Valadares (HNGV - National Hospital Guido Valadares) in Dili.

“ Before the midwife applied NASG, I felt limp and weak. After the NASG was applied I felt better and stronger in just a few minutes, even before we left for the hospital. ”

- Martinha

Martinha received a blood transfusion at HGNV and began feeling better with no further complications.

*\*Patient's name was changed to protect her identity.*

# Background

---

*Maternal Mortality Globally (pg. 6)*

---

*Maternal Health in Timor-Leste (pg. 7)*

---

*Addressing Obstetric Hemorrhage (pg. 8)*

---

*Evidence of NASG Effectiveness (pg. 9)*

---

*How NASG Works (pg. 10)*

---

---

# Maternal Mortality Globally

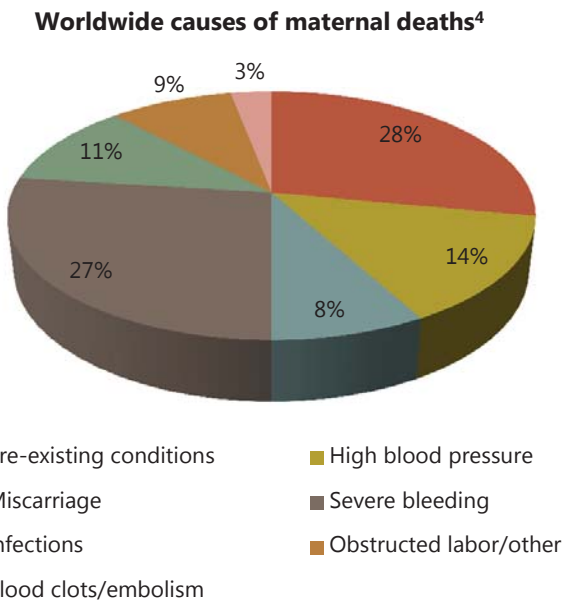
*Despite global progress in reducing maternal mortality in the past two decades, the majority of countries will not meet Millennium Development Goal Five (MDG5) by 2015.<sup>3</sup>*

A disproportionate percentage of maternal deaths worldwide occur in developing countries. In these largely resource-limited settings, health facilities are not equipped with the necessary supplies or skilled personnel to effectively handle obstetric emergencies.

Post-partum hemorrhage (PPH) is one of the leading causes of maternal mortality and morbidity, accounting for approximately 27% of global maternal deaths.

This is exacerbated by other factors that prevent women and their families from seeking and receiving care such as the distance to health facilities, a lack of information about danger signs, a lack of transportation, poverty, cultural practices, and inadequate services.

The majority of maternal deaths are preventable. In addition to ensuring access to appropriate antenatal care during pregnancy, it is also critical to minimize or remove barriers to reaching and accessing skilled care, particularly in the event of an obstetric emergency.



---

## Maternal Health in Timor-Leste

*At 557 deaths per 100,000 live births, Timor-Leste has one of the highest maternal mortality ratios (MMR) in the region.<sup>5</sup>*



Only 30% of births in Timor-Leste are delivered by a skilled provider, with 78% of deliveries occurring outside a health facility.<sup>6</sup> These practices of non-skilled attendance and home deliveries are significant contributors to a high MMR in the country.

Additionally, over 70% of the population lives in rural areas where access to health care is hindered by an inadequate transportation infrastructure and extremely poor road conditions in the largely mountainous terrain. During the rainy season, many roads and bridges are impassable making transportation to certain remote areas almost impossible.

Routine MOH Health Management Information System (HMIS) data reports that 40% of maternal deaths in Timor-Leste are due to PPH, though this percentage could be as high as 50.2%.<sup>7</sup>

Further, Timor-Leste has only a limited number of hospitals capable of providing comprehensive emergency obstetric care (CEmOC) required to address obstetric hemorrhage.

These combined factors place women in Timor-Leste at increased risk of dying from obstetric hemorrhage.

---

# Addressing Obstetric Hemorrhage

*Post-partum hemorrhage (PPH) is defined as blood loss of 500 mL or more within 24 hours after birth. Effective treatment of PPH requires properly trained and skilled personnel as well as facilities equipped with appropriate supplies and medicines.*

Even in situations where proper care and equipment is available, many women and their families experience delays in reaching or receiving services.

The Non-Pneumatic Anti-Shock Garment (NASG) is a low-technology, basic first aid pressure device that can assist in the treatment of PPH through stabilizing severely bleeding women to survive transport and allow health care providers time to apply definitive treatment.

The World Health Organization (WHO) has recommended using NASG to help reduce maternal deaths in settings where definitive care is not immediately available<sup>8</sup> and is included in WHO's *Breakthrough Innovations that Can Save Women and Children Now*.<sup>9</sup>



**NASG buys time.** The estimated time to death from the start of a bleeding complication is often very short - sometimes only two hours. Delays in identifying hemorrhage, reaching care, and receiving care can exacerbate dangers due to bleeding. The NASG slows bleeding and counteracts shock, thus “buying time” until definitive care is received.



**NASG is cost-effective.** Cost-effectiveness information available from Egypt and Nigeria illustrate that for women with severe hypovolemic shock, use of the NASG resulted in improved disability-adjusted life years (DALYs) averted with net savings or low cost per DALY averted.<sup>10</sup> Other evidence from Zambia and Zimbabwe indicate that early NASG application for women in hypovolemic shock is cost-effective across many clinical settings.<sup>11</sup>

---

## Evidence of NASG Effectiveness

*Key advantages to NASG for women and providers include:*

It is easily and quickly applied, taking only about two minutes.

1

Most patients with severe shock regain consciousness and vital signs begin to stabilize with 2-5 minutes of application.

2

Minimal training is required to learn how to apply and remove NASG.

3

***Timor-Leste joins a growing list of countries – such as India, Egypt, Nigeria, Zambia, and Zimbabwe - that have implemented NASG as part of a clinical tool for managing obstetric hemorrhage in resource-limited settings.***

There is a growing body of evidence on the effectiveness of NASG in reducing adverse hemorrhage outcomes.

A cluster randomized trial in Zambia and Zimbabwe demonstrated a 54% reduction in extreme adverse outcomes and a significantly faster shock recovery time due to NASG application.<sup>12</sup>

A study from Egypt and Nigeria found NASG reduced the impact of delays in

receiving definitive therapies after arrival at a tertiary care hospital.<sup>13</sup>

Further evidence from an intervention in Egypt also indicated that use of NASG significantly reduced blood loss and recovery time from shock.<sup>14</sup>

Although further research is still needed, these examples provide compelling evidence that NASG is a valuable innovation to help reduce maternal deaths, particularly in low-resource settings.

---

## How NASG Works

*As blood accumulates in the lower part of the body (in cases of decompensatory shock), leaves the body through the vagina, or pools in the retroperitoneal area (in cases of obstetric hemorrhage), the heart, lungs, and brain are deprived of oxygen. The garment can counter that effect.*



Central circulation is expanded, reversing shock.

Circumferential compression of the abdomen and legs reduces the volume of blood in the compressed areas.

Decreases further blood loss.

*Made of neoprene and Velcro™, this lower body garment provides up to 48 hours of stability during delays.*

## JOANA'S STORY

After delivering a baby boy at Oecusse Referral Hospital, Joana\* – an otherwise healthy 19-year old woman – began to bleed profusely after the uterus failed to contract.

While waiting for the obstetrician to arrive, the midwife began uterine massage. However, Joana still lost a significant amount of blood.

***“When I woke up, I was dressed with this garment. I felt safer, I knew I was going to survive.” - Joana***

Once the NASG was applied, Joana began to stabilize and gained consciousness. The NASG bought the necessary time to treat Joana's condition.

*\*Patient's name was changed to protect her identity.*



# Intervention

---

*Overview of the Intervention (pg. 13)*

---

*Intervention Phase One (pg. 14)*

---

*Contents of PPH Kits (pg. 15)*

---

*Intervention Phase Two (pg. 16)*

---

*Intervention Locations (pg. 17)*

---

*Expansion in Phase Two (pg. 18)*

---

*Training (pg. 19)*

---

*Monitoring System (pg. 20)*

---

*Defining Causes of Hemorrhage (pg. 21)*

---

---

## Overview of the Intervention

Three key elements were employed for the NASG intervention. These included:



### Training

Training was provided to health facility staff and ambulance personnel as well as other facility and MOH support and management staff in NASG device application, removal, and garment care. A total of 1,054 health facility, ambulance, and related staff were trained. Trainings were led by MOH staff, with technical assistance provided by HIP.



### PPH Kit Distribution

HIP provided technical assistance to the MOH in the design of 258 post-partum hemorrhage (PPH) kits distributed to 158 health facilities and ambulances in the intervention area. The kits included the garment as well as materials and medicines - provided by the Medicine and Health Equipment Autonomous Service (SAMÉS) - required to stabilize a woman suffering from PPH.

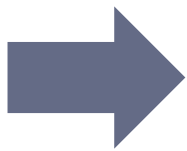


### Monitoring for Decision Making

Ongoing data was captured in the 86 PPH cases presenting at facilities, including specific information on the 40 cases of NASG use. Data was continuously used for decision making and improvements throughout the intervention.

## Intervention Phase One

*The NASG intervention was implemented in two key phases.*



The MOH and HIP collaborated with the University of California at San Francisco (UCSF) in the adaptation of the UCSF NASG training module to the Timorese context.

*HIP provided technical assistance to the MOH in the production of an **interactive training video and curriculum**, all in **Tetum**.*

*This is the **first** of this kind of interactive training video developed in the Timor-Leste context.*

*Other materials developed included: facilitator's manual, participant's guide, job aids, standard operating procedures (SOPs), simulation exercises, and competency checklists.*

*All materials complied with MOH standards and protocols. The full training package was approved by the National Training Institute (INS).*

Phase One focused on select facilities in project target municipalities. Fourteen health posts and community health centers were selected in Ermera and Manatuto municipalities in addition to the *National Hospital Guido Valadares* in Dili.

**15**

*Number of facilities covered in Phase One*

**144**

*Number of health personnel trained in Phase One*

Phase One also trained personnel at all of the 15 pilot facilities following a training of trainers (TOT) workshop held at *National Hospital Guido Valadares* in Dili.

# Contents of PPH Kits

1 NASG

*PPH kits included 1 garment and supplies to manage obstetric hemorrhage.*



PPH Kits were distributed to all targeted facilities with personnel trained in NASG



Application Reference Instructions

1 pair sterile latex surgical gloves

2 IV Catheter/Cannula

2 disposable infusion set

Oxytocin 10 IU

sterile gauze

1 plaster tape

2 alcohol swabs

1 disposable syringe with IV needle



The garment is washable and reusable up to 60 times



Kit materials and medicines were provided by SAMES – Serviço Autonomo de Medicamentos e Equipamentos de Saúde

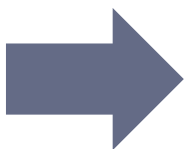
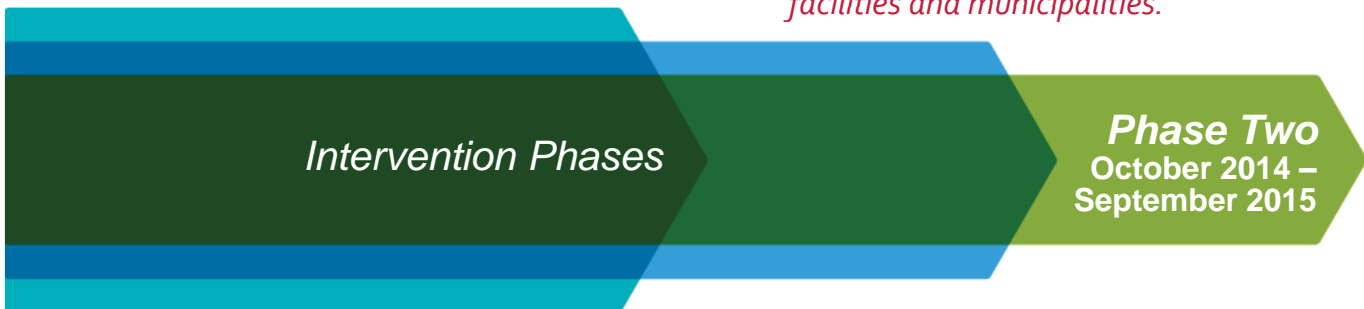


Four liters normal saline or ringer's lactate

**258** PPH kits with NASG were distributed

## Intervention Phase Two

*The second phase received additional funding from USAID's **Development Innovations Ventures (DIV)** to scale-up interventions to other facilities and municipalities.*



### **Referral Hospitals**

*Oecusse (Oecusse region)  
Maliana (Bobonaro municipality)  
Suai (Covalima municipality)  
Maubisse (Ainaro municipality)  
Baucau (Baucau municipality)*

*The National Hospital in Dili and the four Referral Hospitals are the only tertiary level facilities where Comprehensive Emergency Obstetric Care (CEmOC) is provided in the country.*

In Phase Two, the intervention was scaled up to all community health centers (CHCs) and health posts (HPs) conducting deliveries in the Ermera and Manatuto municipalities and in Oecusse region as well as the five referral hospitals in Timor-Leste.

# 143

**Number of facilities covered in Phase Two**

# 910

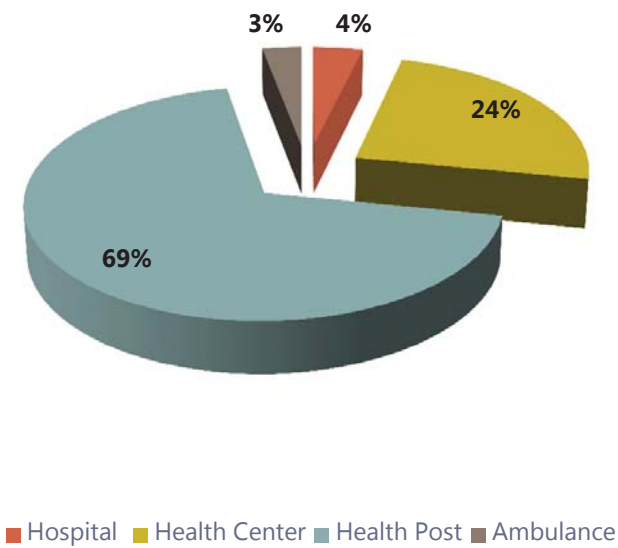
**Health personnel trained in Phase Two**

Personnel were trained in the remaining facilities in the project target municipalities/region of Ermera, Manatuto, and Oecusse; in the 4 Referral Hospitals in Maliana, Suai, Maubisse, and Baucau municipalities; and in HPs and CHCs in Maliana, Baucau, and Suai.

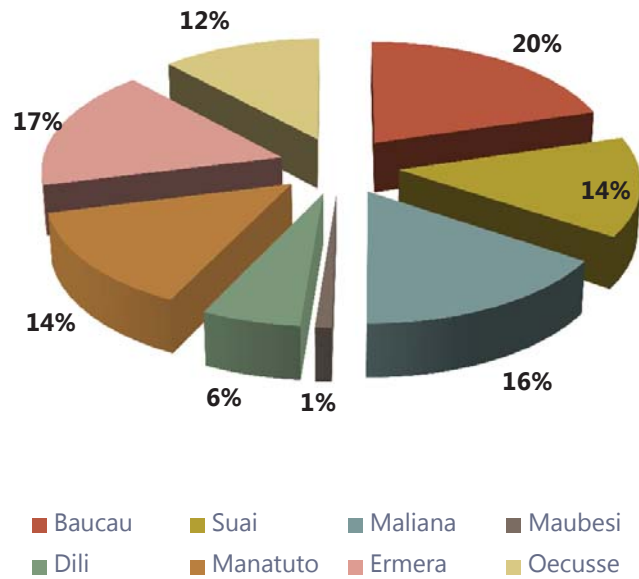
# Intervention Locations

The intervention was conducted in a total of 160 locations.

Distribution of Intervention by Facility Types



Distribution of Intervention by Municipality/Region



## Expansion in Phase Two

*Complementary components were added in Phase Two to enhance intervention effectiveness.*

*Behavior Change  
Communication*

*Strengthened  
Referral System*

*Supportive  
Supervision*

### **Community monitoring and tracking tools for safe motherhood and childhood immunization developed.**

The tool promotes: (1) at least four ANC visits starting in the first trimester; (2) awareness of key danger signs during pregnancy, delivery, and after birth and how to respond; (3) to plan for delivery with a skilled attendant; (4) to attend a minimum of two PNC visits; (5) to vaccinate children within first year.

*Aims to reduce first and second delays in seeking and reaching care.*

### **Transport and referral system designed.**

The system supports a better approach to referrals by advising midwives and doctors of the quickest and most effective way to reach a woman experiencing obstetric complications whose family has contacted the facility.

A list of phone numbers for health facility managers, doctors, midwives, ambulance nurses, ambulance drivers, and other multifunction vehicle drivers is displayed at each health facility and in the community.

*Aims to further overcome the second delay in reaching care.*

### **NASG-specific supportive supervision.**

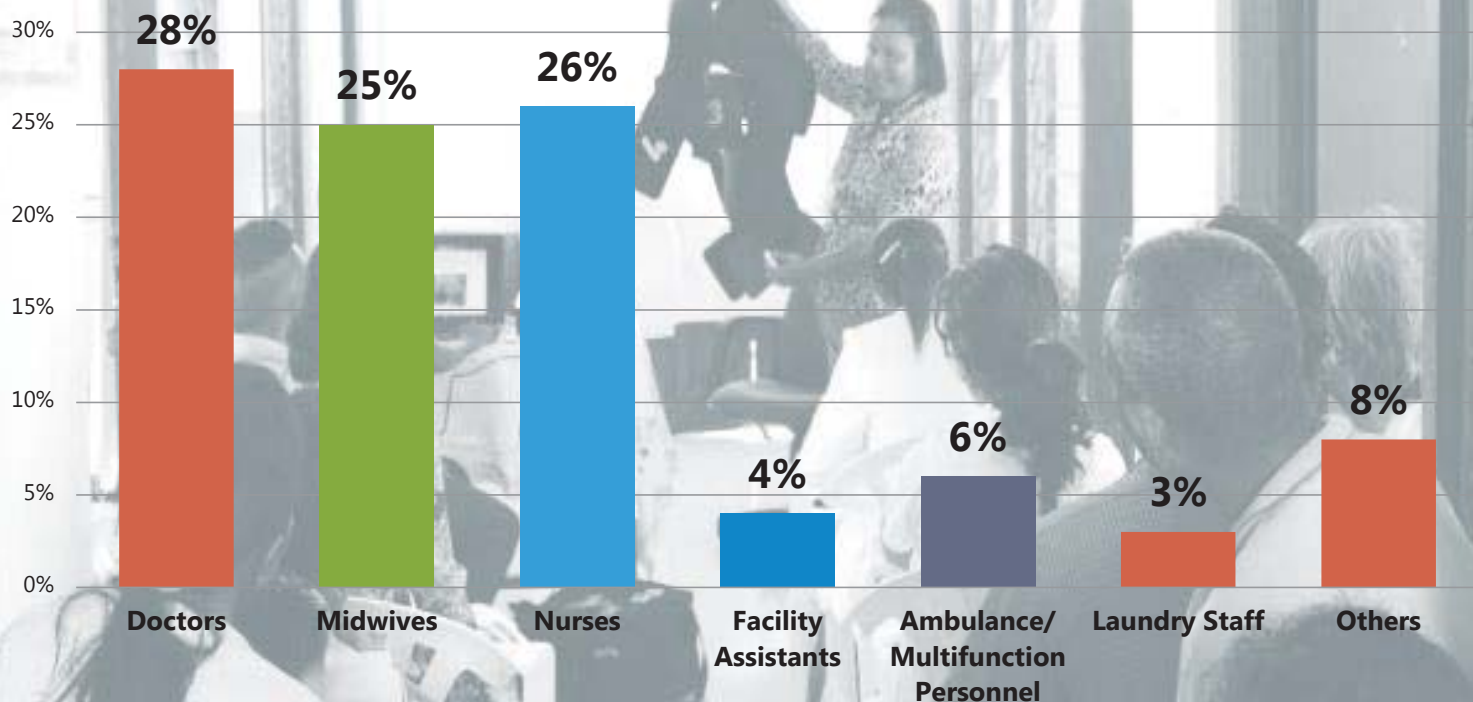
Supervision includes: (1) review of the latest PPH cases and their management; (2) review of trained human resources and status of competency checks; (3) verifying the completeness of PPH kits in stock; and (4) check on personnel's competency on NASG application.

*Aims to reduce the third delay to ensure a woman receives timely care.*

# Training

*A total of 1,054 health personnel were trained, including key health staff such as doctors, midwives, and nurses as well as ambulance staff, laundry staff responsible for cleaning the garments, and other support and management staff.*

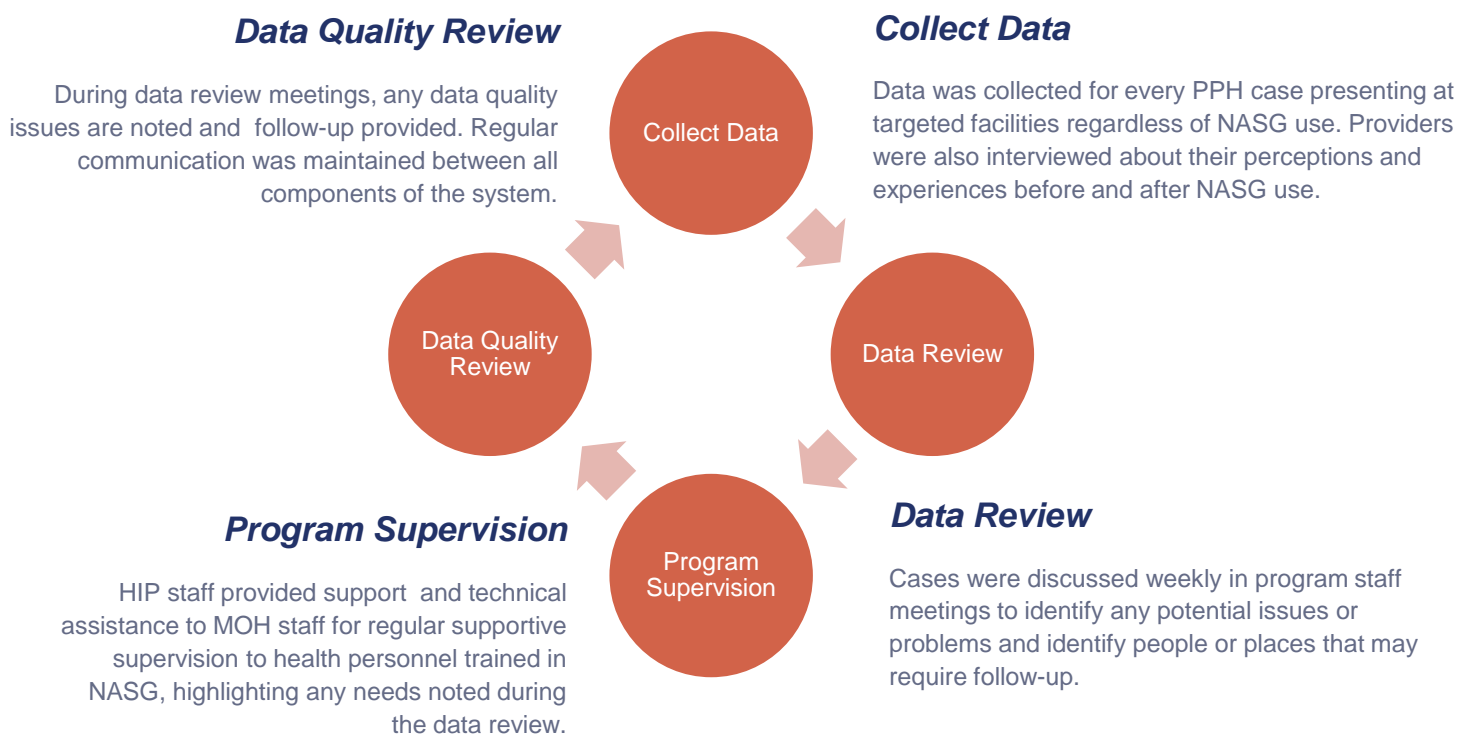
Types of Personnel Trained



---

## Monitoring System

*The NASG monitoring system used **case documentation** to collect information on each PPH case presenting at facilities in the catchment area through an ongoing process of data collection, analysis, and use, with each component feeding into the next in the cycle.*



---

## Defining Causes of Hemorrhage

*The definitions and terminology for hemorrhage causes and any potential modifications within the Timor-Leste context is also useful to reference.*

<i>Hemorrhage Cause</i>	<i>Definition</i>
<b>Abruption</b>	The separation of the placenta from the wall of the uterus.
<b>Miscarriage</b>	Bleeding as a result from miscarriage.
<b>Ruptured uterus</b>	Where the integrity of the myometrial wall is breached. In severe cases with a complete rupture, the contents of the uterus may spill into the peritoneal cavity.
<b>Lacerations</b>	Lacerations of the vaginal opening often occurs when the baby descends quickly, tearing the tissues. More serious lacerations involve the deeper tissues and require surgery.
<b>Retained placenta</b>	A placenta that has not undergone placental expulsion within 30 minutes of the baby's birth. In these cases the third stage of labor needs to be managed actively, otherwise risking hemorrhage and infection.
<b>Placenta previa</b>	Where the placenta whole or partially blocks the neck of the uterus interfering with the normal delivery of the baby.
<b>Uterine atony</b>	The loss of tone in the uterine musculature. A lack of uterine muscle contraction can cause acute hemorrhage as there is no uterine muscle compressing the vessels and reducing blood flow. Therefore the likelihood of coagulation decreases.

## JACINTA'S STORY

After delivering a healthy baby at CHC Gleno, a retained placenta caused 25-year-old Jacinta\* to bleed, quickly losing a significant amount of blood.

Although the midwife and doctor attending the delivery immediately began uterine massage, the bleeding became too severe and Jacinta began going into shock. They applied NASG and transferred her to the National Hospital in Dili.

“After I delivered my baby, I started to bleed very heavily. But after they put the garment on I began to feel the bleeding slow down and I started to feel better.”

- Jacinta

Shortly after the NASG was applied, Jacinta began to stabilize. After she arrived in Dili, Jacinta received a blood transfusion. In a few days she was home with her newborn baby and experienced no further complications.



*\*Patient's name was changed to protect her identity.*

# Results

---

*Case Documentation Description (pg. 24)*

---

*Cases (pg. 25)*

---

*Location of PPH & NASG Use Cases (pg. 26)*

---

*Characteristics of Women (pg. 27)*

---

*Description of Delivery Characteristics (pg. 28)*

---

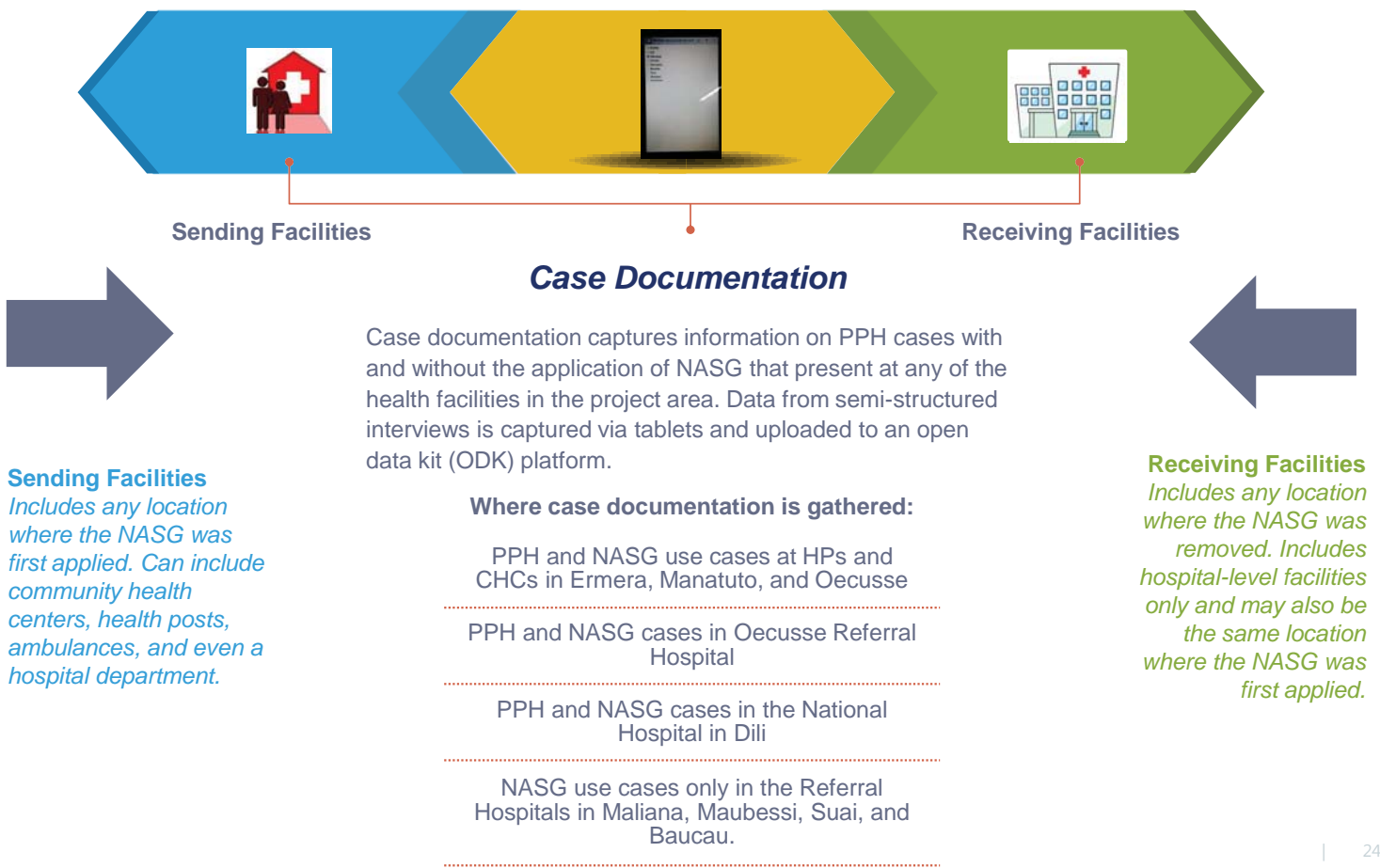
*Description of PPH & NASG Cases (pg. 29)*

---

*Outcomes of NASG Cases (pg. 31)*

---

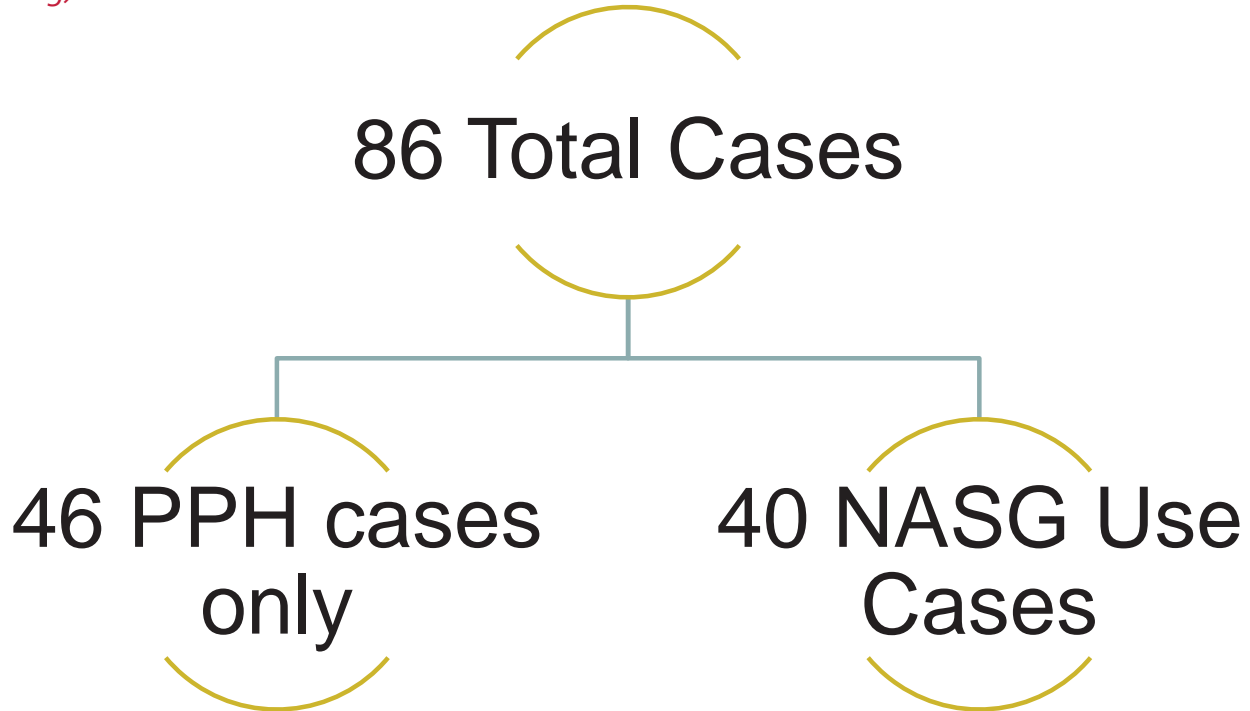
# Case Documentation Description



---

## Cases

Data for case documentation were collected from **November 2014 to September 2015**. There were a total of **86 PPH cases** presenting at facilities. Among those, 40 cases required NASG (or **47%** of the cases presenting).

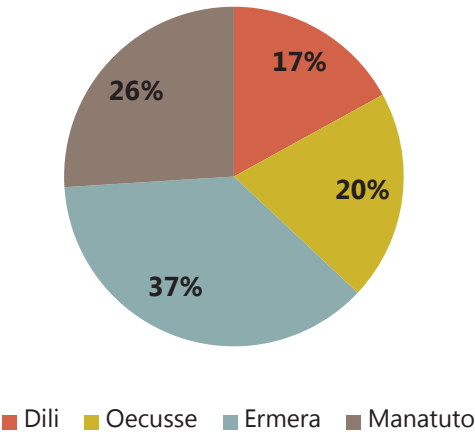


# Location of PPH and NASG Use Cases

A total of 86 PPH cases presented at facilities during the implementation period. In 40 of those cases, NASG was applied and then transferred for definitive treatment. In 46 of those cases, the PPH was treated at the presenting facility or transferred to be treated at a tertiary level facility. In order to provide a level of comparison, results will be presented for the PPH cases not treated with NASG (n=46) and the PPH cases treated with NASG (n=40).

**46** Number of PPH cases presenting at target facilities from November 2014 – September 2015.

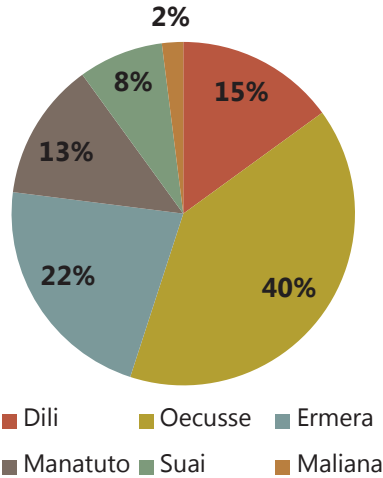
Location of PPH Cases



Number of cases where NASG was applied at target facilities from November 2014 – September 2015.

**40**

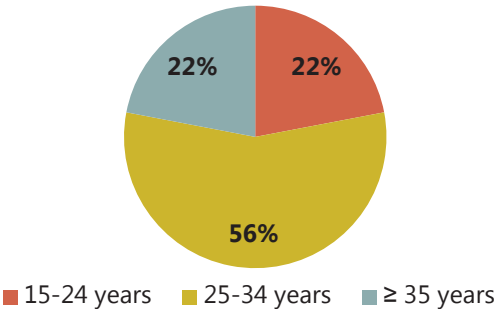
Location of NASG Cases



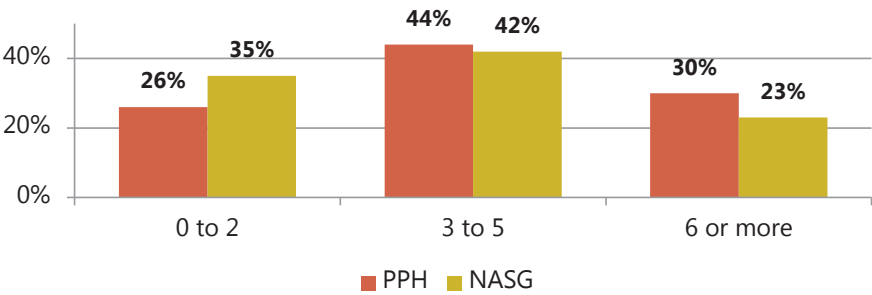
# Characteristics of Women

*NASG was applied to a larger proportion of younger women; the majority of both PPH and NASG women had 3-5 previous pregnancies, but a higher proportion of PPH-only women had 3 to 5 previous births.*

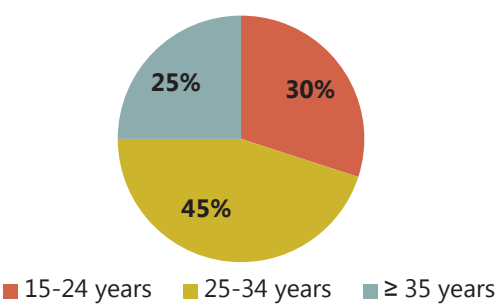
Age among PPH cases (n=46)



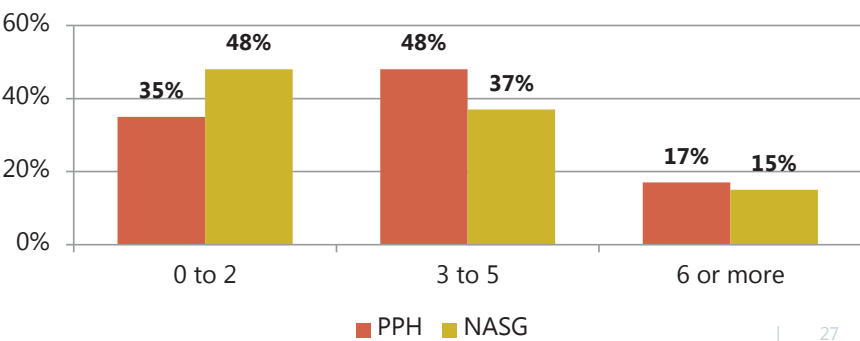
Previous pregnancies among PPH & NASG cases



Age among NASG cases (n=40)



Previous births among PPH & NASG cases

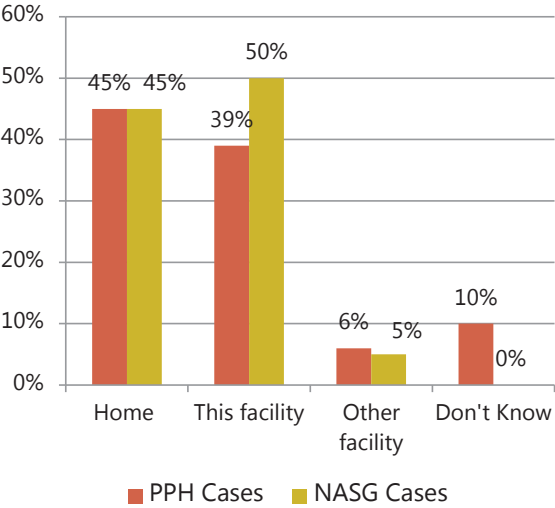


# Description of Delivery Characteristics

67% 31 of 46 women with PPH delivered

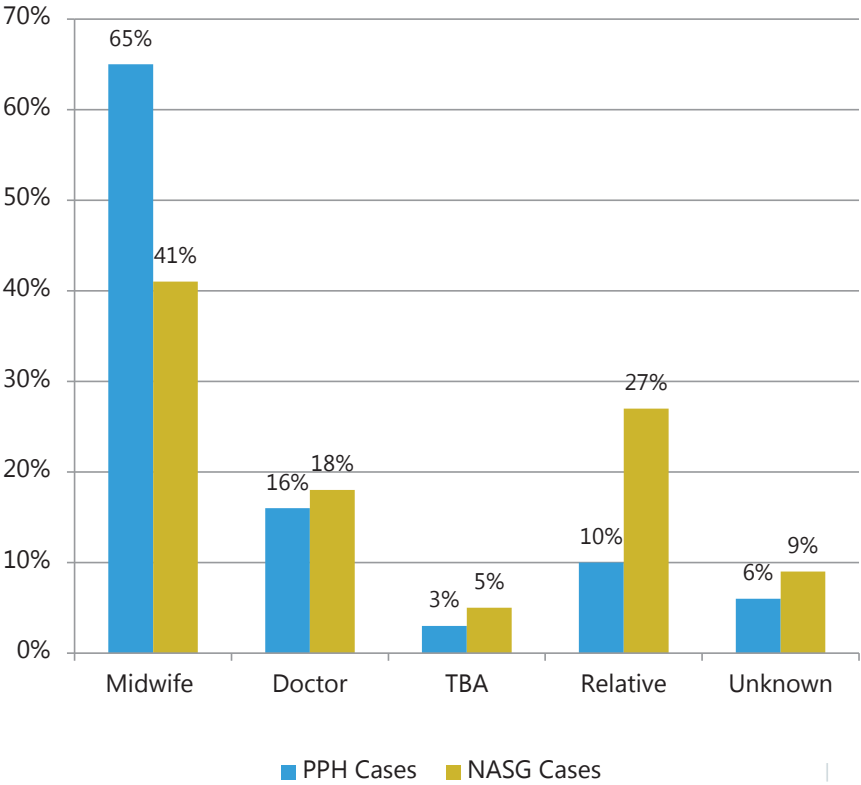
55% 22 of 40 women where NASG was used delivered

Delivery Location



While similar proportions of women delivered at home, a higher proportion of women where NASG was used delivered at a facility. However, two times as many deliveries were conducted by a relative in PPH cases where NASG had to be used.

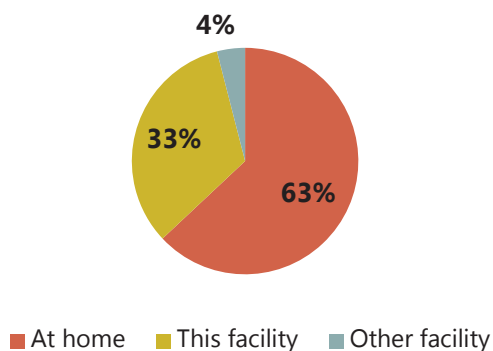
Person Conducting Delivery



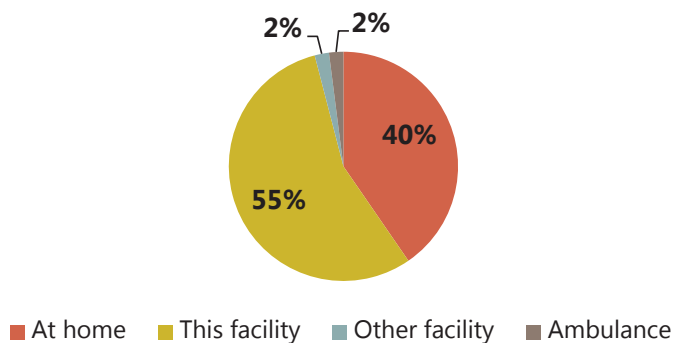
# Description of PPH & NASG Cases

For the majority of PPH cases, hemorrhage started at home (63%) before going to the facility. For the majority of cases where NASG was used, the bleeding began at the health facility (55%). In 90% of the NASG cases the woman had a blood loss of 500 mL or more.

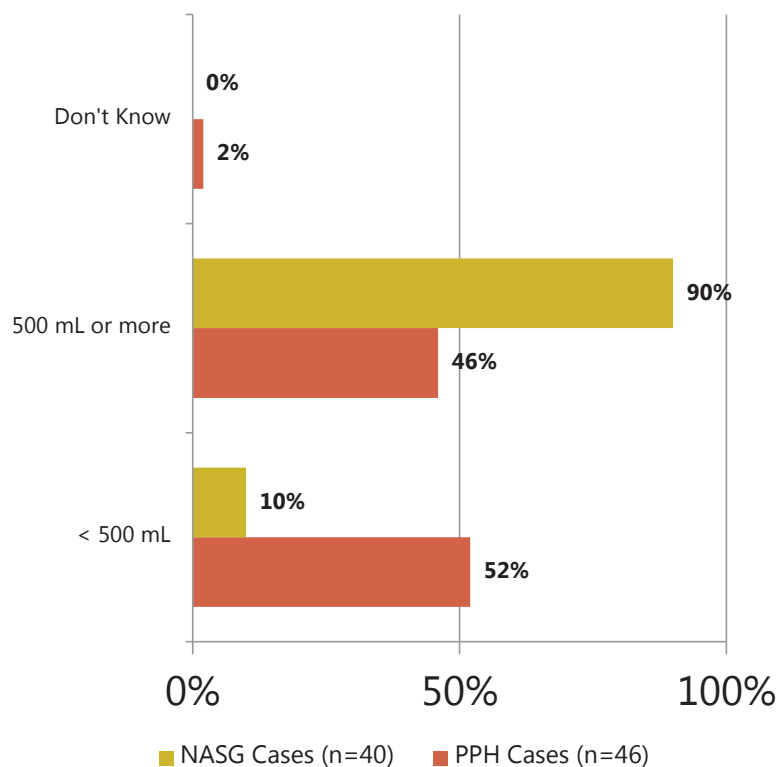
PPH Onset Location for PPH Cases (n=46)



PPH Onset Location for NASG Use Cases (n=40)

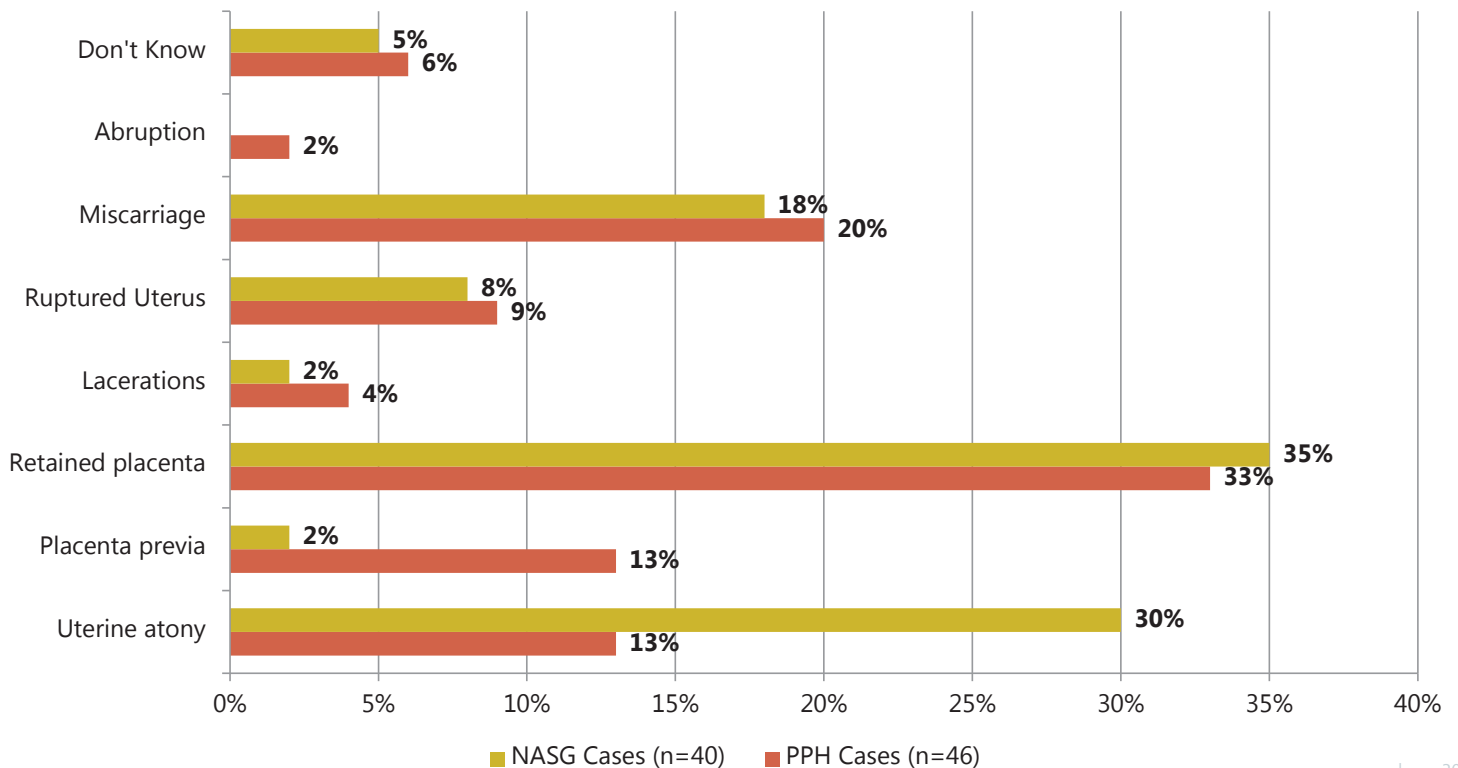


PPH Onset Location for All Cases



## Description of PPH & NASG Cases

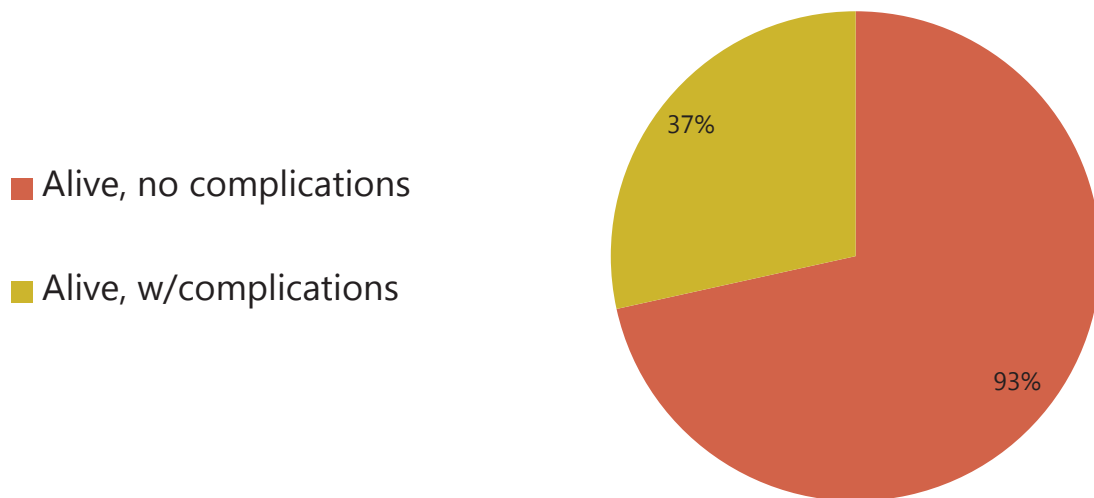
*For the majority of both PPH-only and NASG use cases, the primary cause of hemorrhage was retained placenta at 33% and 35%, respectively. The next leading cause differed - abortion complications for PPH only cases (20%) and uterine atony (30%) for NASG use cases.*



## Outcomes of NASG Cases

*In all cases where NASG was used, the woman survived. Complications cited by providers were not a result of NASG use but rather general conditions the woman had upon discharge, which were treated.*

**NASG Case Outcomes (n=40)**



*\*Complications included anemia (2 cases) and puerperal infection (1 case)*



## LUISANA'S STORY

While Luisana\* was at home she suffered a miscarriage with her first pregnancy. She began to bleed heavily so her family brought her to the nearest facility, Health Post Salau.

Soon after arrival, Luisana began going into shock. The midwife applied the NASG and called the multifunction vehicle to transport her to the National Hospital in Dili. There, she received a blood transfusion and soon stabilized.

While NASG buys life-saving time for women, it also provides a life-saving skill to health personnel.

***“Before NASG, when I transported a woman with bleeding I felt very nervous that she would not survive the trip. Now with NASG training, I don’t feel nervous. I have confidence that the woman will arrive safely.” – Ambulance driver***

*\*Patient’s name was changed to protect her identity.*

# Summary

---

*NASG: An Effective Tool (pg. 34)*

---

*Lessons Learned (pg. 35)*

---

*Conclusion: The Road Forward (pg. 38)*

---

---

## NASG: An Effective Tool

Initial experiences implementing and scaling-up NASG in Timor-Leste have provided positive and promising results. The Ministry of Health (MOH) – as well as many Timorese providers who have experienced first-hand the benefits of having the NASG available for cases of severe obstetric bleeding – have expressed interest in scaling-up NASG nationally so that **all** facilities have the capacity and means with which to offer this life-saving treatment option to women experiencing post-partum hemorrhage.

While there are some known risk factors for PPH such as prolonged third stage of labor, multiple deliveries, age over 35 years, instrumental deliveries, and a history of postpartum hemorrhage<sup>15,16</sup> for example, for the majority of women PPH cannot be predicted. Providers need to act quickly using proven techniques in order to manage the bleeding and help the woman recover. Providers in low resource settings are particularly challenged in providing the care that is needed. But the availability of NASG has proven a life-saving tool for PPH cases in Timor-Leste.

*Evidence to date shows NASG to be an effective tool in stabilizing hemorrhaging women during delays in reaching care.*

*Recommended by the World Health Organization (WHO), it is increasingly being recognized and included as a component of comprehensive programs to manage obstetric hemorrhage in a growing number of countries. NASG has proven essential in resource-limited countries particularly challenged by delays in reaching definitive care.*



---

## Lessons Learned

*Monitoring cases of PPH and NASG to date in Timor-Leste have provided some lessons learned that may be useful to consider for future scale-up of the NASG program or for programs considering implementation of a similar program.*

- **Identifying advocates or “champions” can help encourage provider use of NASG in appropriate cases.** Providers are key gatekeepers to the use of a new technology. If they are unsure about an innovation or not convinced of its utility, the innovation may often see minimal to no use. However, once convinced of its advantages, providers can serve as key advocates which can not only increase use but can also encourage other changes that may be needed such as supportive policies or demand generation to keep costs low. Identifying those with positive experiences - such as early adopters at Oecusse Referral Hospital where 40% of NASG-use cases occurred - can cultivate provider support which is important when considering program improvements and scale-up.
- **Encourage antenatal care (ANC) visits and integration of birth preparedness planning during these visits.** For the 50% of women that delivered in a health facility and developed obstetric hemorrhage where NASG was used, the life-saving device was immediately available as a treatment option. However, 45% of women that delivered at home where NASG was eventually used likely encountered delays in reaching a facility before NASG could even be applied. Further, relatives or traditional birth attendants (TBAs) are often not as skilled in recognizing danger signs requiring medical attention. Facility-based deliveries with skilled birth attendants help ensure women have access to the best life-saving options available to them and as quickly as possible.

---

## Lessons Learned



- **ANC visits help ensure that any pre-existing conditions or other risk factors for post-partum hemorrhage (PPH) may be able to be identified and treated to minimize the risk.** A small proportion of women where NASG was used were noted as having severe anemia, which was most likely a pre-existing condition. Although the women were treated with iron supplements upon discharge, it is also important to continue to encourage ANC visits to help providers identify and treat any pre-existing conditions – such as maternal anemia - that may put the woman at additional risk.
- **Support effective blood donation systems.** While NASG is a tool that can effectively slow bleeding, it is not a treatment for hemorrhage. Therefore it is important to ensure that countries have well-functioning blood donation systems where tested blood is readily available when needed for a woman's full recovery.

---

## Lessons Learned

- **Identify means with which to promote NASG at the community.** While providers and facility-based improvements represent the “supply” side of providing quality services, equally important is the acceptance of and demand for the innovation from the “demand” side – i.e. the community. Families may be afraid to allow the use of NASG due to their lack of understanding about the device or awareness of the life-saving benefits. Ensuring community members are appropriately informed – before or early in the pregnancy - is important in ensuring NASG is permitted to be used to maximize the benefits of the tool.
- **Strengthen the overall health system to support providers in the equipment and supplies needed to provide comprehensive care.** The NASG is not intended to be a stand-alone panacea for addressing post-partum hemorrhage. Rather, NASG is one tool in a “continuum of care” approach that can help providers address a woman’s needs – from prevention to treatment – throughout the childbearing stages. Ensuring that facilities are properly equipped, supplied, and functional are critical elements to a provider’s ability to respond to the needs of the situation.



---

## Conclusion: The Road Forward

*Post-partum hemorrhage (PPH) is the leading cause of maternal mortality globally, but the condition is also largely preventable. Through active management of the third stage of labor (AMSTL) which involves uterotonic medicines, controlled cord traction, and uterine massage, many cases of death and disability from PPH can be averted.*

However, many health workers are often encumbered by drug stock outs or a lack of other equipment at the facility.

This is further complicated by delays - delays in deciding to seek care, delays in reaching care at a facility, and/or delays in receiving definitive care at an appropriate tertiary level facility that provides comprehensive emergency obstetric care (CEmOC).

NASG is an easy-to-use life saving tool that can help overcome these delays and other constraining factors in the ability of health workers to administer treatment. Through slowing bleeding and stabilizing the patient until she can reach definitive care, women's lives can be saved.

Programs considering NASG implementation would benefit from ensuring that NASG is one tool in a total care approach for the overall management of post partum hemorrhage. Improving the ability of providers and facilities to "supply" life-saving services and generating community support to "demand" these services can help facilitate strong programs that are available when needed.

The experience to date in Timor-Leste has provided promising and positive evidence in support of expanding the program to the national level.

Each and every Timorese women deserves to have access to high quality maternal health care. NASG is a simple, low-cost hemorrhage management device that can be used to buy the time needed until treatment can be received to save lives.



---

## References

- (1) WHO Maternal Mortality Fact Sheet at <http://www.who.int/mediacentre/factsheets/fs348/en/>. Accessed on 22 September 2015.
- (2) Stenberg, K. et al. (2014) Advancing social and economic development by investing in women's and children's health: a new Global Investment Framework, *Lancet*, April: 1333- 1354.
- (3) Hogan MC, Foreman KJ, Naghavi M, Ahn SY, Wang M, et al. (2010) Maternal mortality for 181 countries, 1980-2008: a systematic analysis of progress towards Millennium Development Goal 5, *Lancet* 375: 1609-1623.
- (4) Say L et al. (2014) Global Causes of Maternal Death: A WHO Systematic Analysis, *Lancet*, Volume 2, Issue 6, e323-e333.
- (5) National Statistics Directorate (NSD) [Timor-Leste], Ministry of Finance [Timor-Leste], and ICF Macro. 2010. *Timor-Leste Demographic and Health Survey 2009-10*. Dili, Timor-Leste: NSD [Timor-Leste] and ICF Macro.
- (6) National Statistics Directorate (NSD) [Timor-Leste], Ministry of Finance [Timor-Leste], and ICF Macro. 2010. *Timor-Leste Demographic and Health Survey 2009-10*. Dili, Timor-Leste: NSD [Timor-Leste] and ICF Macro.
- (7) The Ministry of Health of the Democratic Republic of Timor-Leste. 2011. National Health Sector Strategic Plan 2011-2030.
- (8) Miller S, Bergel EF, El Ayadi AK, et al. (2013) Non-Pneumatic Anti-Shock Garment (NASG), a first-aid device to decrease maternal mortality from obstetric hemorrhage: a cluster randomized trial, *PLOS One*, Volume 8, Issue 10: e76477.
- (9) Breakthrough Innovations that Can Save Women and Children Now, Every Woman Every Child/PATH/UN Foundation accessed at [www.path.org/innovations2015/](http://www.path.org/innovations2015/).
- (10) Sutherland T, Downing J, Miller S, et al. (2013) Use of the Non-Pneumatic Anti-Shock Garment (NASG) for life-threatening obstetric hemorrhage: a cost-effectiveness analysis in Egypt and Nigeria. *PLOS One*, Volume 8, Issue 4: e62282.
- (11) Downing J, El Ayadi A, Miller S, et al. (2015) Cost-effectiveness of the non-pneumatic anti-shock garment (NASG): evidence from a cluster randomized controlled trial in Zambia and Zimbabwe. *BMC Health Services Research*, 15, 37.

---

## References

- (12) Miller S, Bergel EF, El Ayadi AK, et al. (2013) Non-Pneumatic Anti-Shock Garment (NASG), a first-aid device to decrease maternal mortality from obstetric hemorrhage: a cluster randomized trial *PLOS One*, Volume 8, Issue 10: e76477.
- (13) Turan J, Ojengbede O, Fathalla M, et al. (2011) Positive effects of the Non-Pneumatic Anti-Shock Garment on delays in accessing care for postpartum and post abortion hemorrhage in Egypt and Nigeria, *Journal of Women's Health*, Volume 20.
- (14) Turan J, Ojengbede O, Fathalla M, et al. (2011) Positive effects of the Non-Pneumatic Anti-Shock Garment on delays in accessing care for postpartum and post abortion hemorrhage in Egypt and Nigeria, *Journal of Women's Health*, Volume 20.
- (15) Al-Zirqi I, Vangen S, Forsen L, Stray-Pedersen B. Prevalence and risk factors of severe obstetric haemorrhage. *BJOG Int J Obstet Gynaecol.* 2008;115(10):1265-72.
- (16) Sheldon W, Blum J, Vogel J, Souza J, Gülmezoglu A, Winikoff B, et al. Postpartum haemorrhage management, risks, and maternal outcomes: findings from the World Health Organization Multicountry Survey on Maternal and Newborn Health. *BJOG Int J Obstet Gynaecol.* 2014;121(Suppl 1):5–13.