Non-Pneumatic Anti-Shock Garment (NASG) Use in Postpartum Hemorrhage Control: A Midwifery Practice Assessment in Ogun State, Nigeria

Ibidunmoye Regina Ronke[1]

[1]Department of Nursing Sciences Babcock University, Ogun State, Nigeria

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Abstract

- *Background:*
  Postpartum haemorrhage (PPH) remains the leading cause of maternal mortality globally, accounting for approximately 25% of all maternal deaths. The NonPneumatic AntiShock Garment (NASG) is a firstaid lowerbody pressure device that reverses hypovolemic shock and decreases obstetric hemorrhage, thereby reducing maternal morbidity and mortality.

- *Objective:*
  This study assessed the knowledge, perception, attitude, and utilization of NASG in the management of postpartum hemorrhage among midwives in selected healthcare facilities in Ogun State, Nigeria.

- *Methods:*
  A descriptive crosssectional research design was employed using a structured questionnaire for data collection from 173 midwives in two tertiary hospitals: Babcock University Teaching Hospital and Olabisi Onabanjo University Teaching Hospital, Ogun State. Data were analyzed using descriptive statistics, and Pearson Product Moment Correlation was used to test hypotheses at 5% level of significance.

- *Results:*
  The findings revealed that midwives had moderate knowledge (mean score = 6.609, 50.8%) on NASG utilization in PPH management. Their perception towards NASG utilization was average (54.3%), while their attitude was fair (mean = 2.21 on a 4point scale). An inverse significant association was found between knowledge and utilization of NASG (r = 0.612, p = 0.000). Major barriers to utilization included nonavailability (73.4%), inadequacy of NASG (76.9%), and infection risk concerns (67.6%).

- *Conclusion:*
  Despite moderate knowledge among midwives, NASG utilization remains suboptimal due to availability challenges and infrastructural constraints. Continuous education, periodic training, and ensuring adequate supply of NASG in healthcare facilities are essential to maximize its lifesaving potential.

Keywords: *Nonpneumatic Antishock Garment, Postpartum Hemorrhage, Midwives, Knowledge, Utilization, Maternal Mortality, Nigeria.*

I. INTRODUCTION

Postpartum hemorrhage (PPH) is defined by the World Health Organization (WHO) as excessive loss of blood (500ml or more) after childbirth (WHO, 2017). It remains the most common complication of childbirth and the leading cause of maternal mortality in lowincome countries, responsible for approximately 25% of all maternal deaths globally (Wormer, Jamil, & Bryant, 2019; WHO, 2017). Estimates indicate that approximately 14 million women suffer primary postpartum hemorrhage annually, with about 70,000 deaths resulting from obstetric

hemorrhage (Green, Ojule, & Faith, 2015; Miller & Safe Motherhood Program, 2015).

Nigeria constitutes 2% of the world's population but contributes 14% of global maternal deaths (WHO, UNICEF, UNFPA, & World Bank, 2015). With an estimated 40,000 women dying annually from pregnancy complications and childbirth, Nigeria has the most alarming maternal mortality record after India (WHO, 2015). The 2018 Nigeria Demographic and Health Survey reported a maternal mortality ratio of 512 deaths per 100,000 live births, though recent estimates suggest this may be as high as 814 per 100,000 live births in 2024 (National Population Commission, 2019).

- *The NonPneumatic AntiShock Garment (NASG)*

The NonPneumatic AntiShock Garment (NASG) is a lowtechnology, firstaid device applied in the treatment and management of hypovolemic shock secondary to obstetric hemorrhage (Onasoga, Duke, Danide, & JackIde, 2015). It is a lightweight neoprene garment consisting of five segments fastened firmly around the legs, pelvis, and abdomen (PileggiCastro et al., 2015).

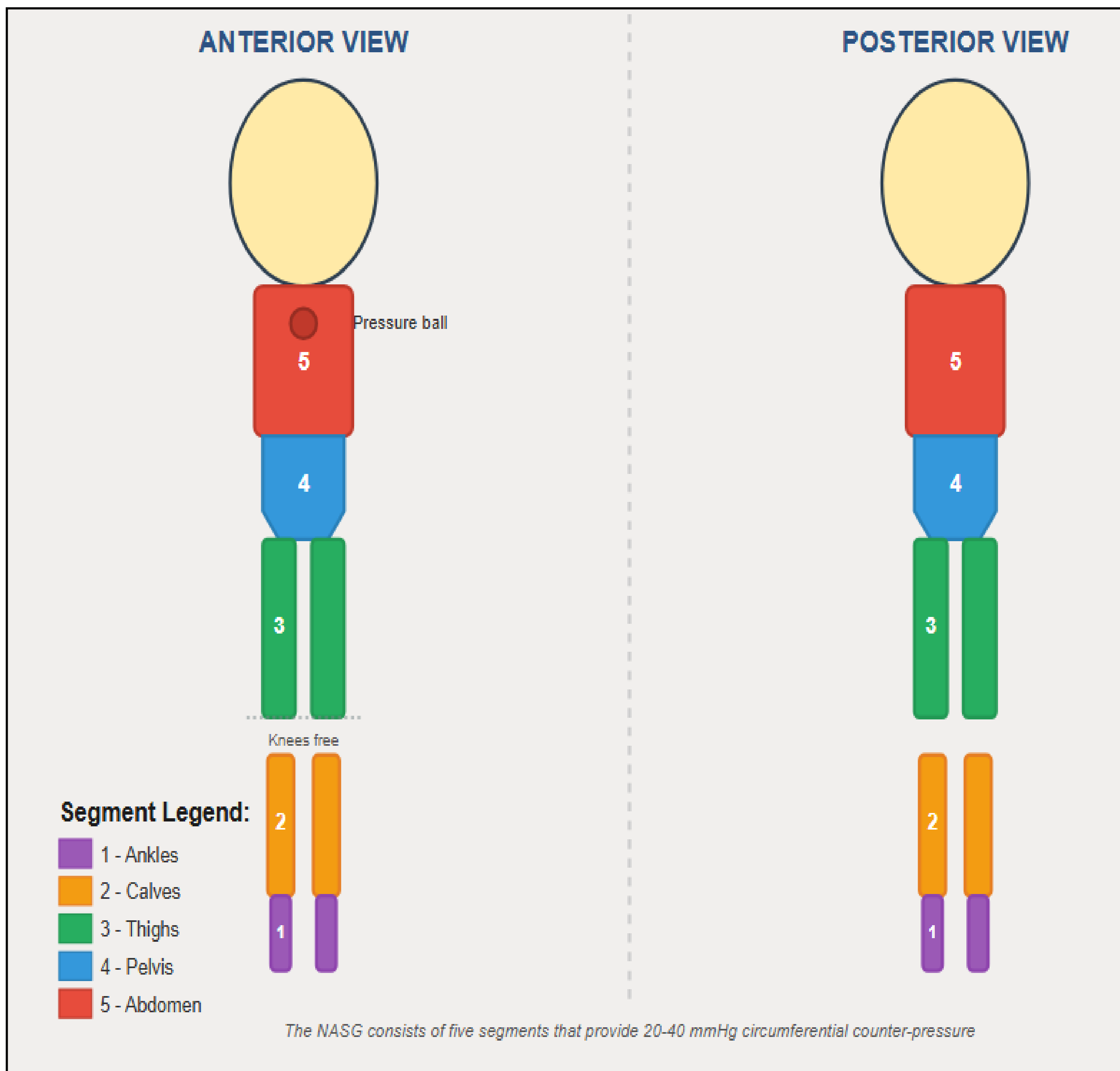

Fig 1 Posterior and Anterior Views of NASG

The mechanism of action involves exerting circumferential counterpressure (2040 mmHg) to the lower extremities, resulting in blood shunts to essential organs such as the heart, lungs, and brain, thereby maintaining patient stability while awaiting definitive care (Onasoga et al., 2015; Stenson, Miller, & Lester, 2012).

- *Efficacy of NASG*

Multiple studies have demonstrated the effectiveness of NASG in reducing maternal mortality and morbidity from PPH. A pilot study conducted in Egypt and Nigeria between 2007 and 2012 by Miller and colleagues reported a 54% reduction in maternal mortality when women

received NASG at the primary level prior to transportation to reference or tertiary hospitals (Sharma et al., 2016).

Recent systematic reviews (20202024) have reinforced these findings, with evidence showing that NASG use significantly reduces:

- Blood loss by approximately 50% (Escobar et al., 2017)
- Emergency hysterectomy rates by 56% (Miller et al., 2016)
- Severe morbidities by 81% (Miller et al., 2016)
- Mortality rates by 44% (MouradYoussif et al., 2010)

In 2013, both the World Health Organization (WHO) and the International Federation of Gynecologists and Obstetricians officially included NASG in their guidelines on PPH management (Miller & Safe Motherhood Program, 2016).

➢ *Problem Statement*

Despite the proven efficacy of NASG, preventable hypovolemic shock and death from postpartum hemorrhage continue to occur due to delays in circulating volume restoration, untimely and inadequate blood/fluid replacements, and delays in transporting referrals to specialist facilities (Miller et al., 2013).

- *In Nigeria, the Problem is Compounded by Several Factors:*

✓ Lack of funding resulting in equipment shortages in federal hospitals
✓ Absence of technical knowhow or underutilization of available equipment (Ogbeye, Ohaeri, & Olatubi, 2015)
✓ Limited awareness among healthcare providers
✓ Noninclusion of NASG in standard PPH management protocols

According to Onasoga, Awhanaa, and Ameignene (2014), midwives are the first point of contact for most women during pregnancy and labour, and all women are at risk of postpartum hemorrhage. Therefore, midwives must be aware of NASG use as a quick and adequate means of providing emergency obstetric care during PPH.

➢ *Study Objectives*

The general objective was to assess the utilization of NASG by midwives in the management of postpartum hemorrhage. Specific objectives were to:

- Assess the knowledge of midwives on the utilization of NASG in PPH management
- Assess the perception of midwives towards NASG utilization
- Determine midwives' attitude towards NASG utilization
- Identify the extent to which midwives use NASG in PPH management

➢ *Research Hypotheses*

- There is no significant association between the knowledge of midwives and the utilization of NASG in the control of postpartum hemorrhage
- There is no significant association between the attitude of midwives and the utilization of NASG in the control of postpartum hemorrhage

II. LITERATURE REVIEW

➢ *Postpartum Hemorrhage: Definition and Epidemiology*

PPH is traditionally defined as blood loss greater than 500ml during vaginal delivery or greater than 1,000ml with cesarean delivery (WHO, 2017). However, some authors suggest that PPH should be diagnosed with any amount of blood loss that threatens the hemodynamic stability of the woman (Smith & Barnaba, 2015).

The incidence of PPH varies widely depending on population and obstetric practice, ranging from 15% of all deliveries (Jacob, 2012). However, in Nigeria, studies have reported varying incidence rates. Anya (1999) reported a 2.72% incidence with a case fatality rate of 3.25% in Umuahia, Eastern Nigeria. More recent studies indicate that PPH contributes significantly to the high maternal mortality ratio, with some states reporting that 1734.7% of maternal deaths result from PPH (Kullami et al., 2015; Agida, 2010).

➢ *Causes and Risk Factors*

The causes of PPH are classically divided into four main groups, known as the "4 Ts" (Garcia et al., 2017):

- Tone (Uterine Atony): Responsible for 7590% of PPH cases, resulting from inadequate contraction of uterine myometrial cells (Green et al., 2015; Gill, Patel, & Van Hook, 2019)
- Trauma: Including genital tract lacerations, uterine rupture, and uterine inversion
- Tissue: Retained placenta or placental fragments interfering with uterine contraction
- Thrombin: Coagulation disorders including inherited coagulopathies, disseminated intravascular coagulation (DIC), and dilutional coagulopathy

Risk factors include high maternal parity, chorioamnionitis, prolonged oxytocin use, multiple gestation, polyhydramnios, fetal macrosomia, and previous history of PPH (Wormer et al., 2019).

➢ *Current Management Strategies*

The management of PPH follows a hierarchical approach (Gill et al., 2019):

- *Emergency Treatment:*

✓ Blood transfusion and volume replacement with intravenous fluids
✓ Active management of third stage of labour (AMTSL)

- *Initial Medical Treatment:*

✓ Uterotonic drugs (oxytocin as firstline: 10 IU IM/IV)
✓ Prostaglandins
✓ Tranexamic acid (antifibrinolytic agent)

- *Mechanical Interventions:*

✓ Bimanual uterine compression
✓ Bakri balloon tamponade
✓ Nonpneumatic antishock garment (NASG)

- *Surgical Treatment:*

✓ Uterine compression sutures
✓ Selective arterial embolization
✓ Hysterectomy (last resort)

The AMTSL protocol, involving prophylactic uterotonics, controlled cord traction, and uterine massage, has been shown to reduce PPH by 60% (Ojengbede et al., 2011). However, many women still experience hemorrhage due to lack of adherence to protocols, medication unavailability, and treatment delays.

➢ *Historical Development and Mechanism of NASG*

The use of hypovolemic compression suits dates back to the early 1900s when Dr. George Crile created the first pneumatic suit. During World War II, the concept was reintroduced as the gravity suit (Gsuit) for the Army Air Corps. This evolved into the Military Medical AntiShock Trousers (MAST) during the Vietnam War (Karochi, Lalonde, & BEnrigh, 2012; Stenson et al., 2012).

The nonpneumatic version (NASG) was developed by Dr. Ralph Pelligra of NASA/Ames Research Centre in 1971, receiving FDA 510(k) medical device approval in 1991 (Miller et al., 2013). Unlike pneumatic versions, NASG has no bladders, tubing, or gauges, making it easier to use without risk of overinflation.

- *Mechanism of Action:*

The NASG exerts 2040 mmHg circumferential counterpressure on the lower body, which:

✓ Shunts blood from lower extremities to vital organs (heart, lungs, brain)
✓ Directly compresses the descending aorta, counteracting blood flow from uterine arteries
✓ Reduces total vascular volume, increasing perfusion and cardiac output
✓ Decreases blood loss and reverses hypovolemic shock (Escobar et al., 2017; Onasoga et al., 2015)

➢ *Clinical Evidence on NASG Effectiveness*

- *Egyptian Study (2006):*

Miller et al. (2006) studied 249 women with obstetric hemorrhage in Egypt, comparing preintervention (n=104) and NASG intervention groups (n=145). Results showed:

✓ Median recovery time to normal shock index: 75 minutes (NASG) vs. 120 minutes (control), p=0.003
✓ Pulse recovery time: 90 minutes (NASG) vs. 180 minutes (control), p<0.001
✓ Blood loss reduction: 299ml (NASG) vs. 603ml (control) 50% reduction

- *Egypt Nigeria MultiSite Study (2010):*

Mourad Youssif et al. (2010) conducted a study in four referral facilities in Nigeria and two in Egypt (N=854 women). Entry criteria included estimated blood loss â‰¥750ml and clinical signs of shock. Results demonstrated:

✓ Measured blood loss decreased by 50%: 200ml (NASG phase) vs. 400ml (preintervention)
✓ Mortality decreased from 9% to 3.1%
✓ Severe morbidity decreased from 4.2% to 1%

- *Zimbabwe Zambia Randomized Study (2012):*

Funded by the Bill and Melinda Gates Foundation and NIH, this study provided evidence that led to WHO's official recommendation of NASG in 2013 (Miller, 2016).

- *Colombian Experience (2017):*

Escobar et al. (2017) studied 77 women with hypovolemic shock secondary to PPH at FundaciÃ³n Valle Del Lili, Cali. The study concluded that NASG aided rapid restoration of circulatory normality, helped avoid metabolic derangement, and decreased the probability of invasive treatments and massive transfusions.

➢ *Application and Removal Protocol*

- *Application Sequence (WHO, 2015):*

✓ Place NASG under the patient
✓ Close segment 1 tightly around ankles
✓ Close segment 2 tightly around each calf
✓ Close segment 3 tightly around thighs, leaving knees free
✓ Close segment 4 around the pelvis
✓ Close segment 5 with pressure ball over the umbilicus

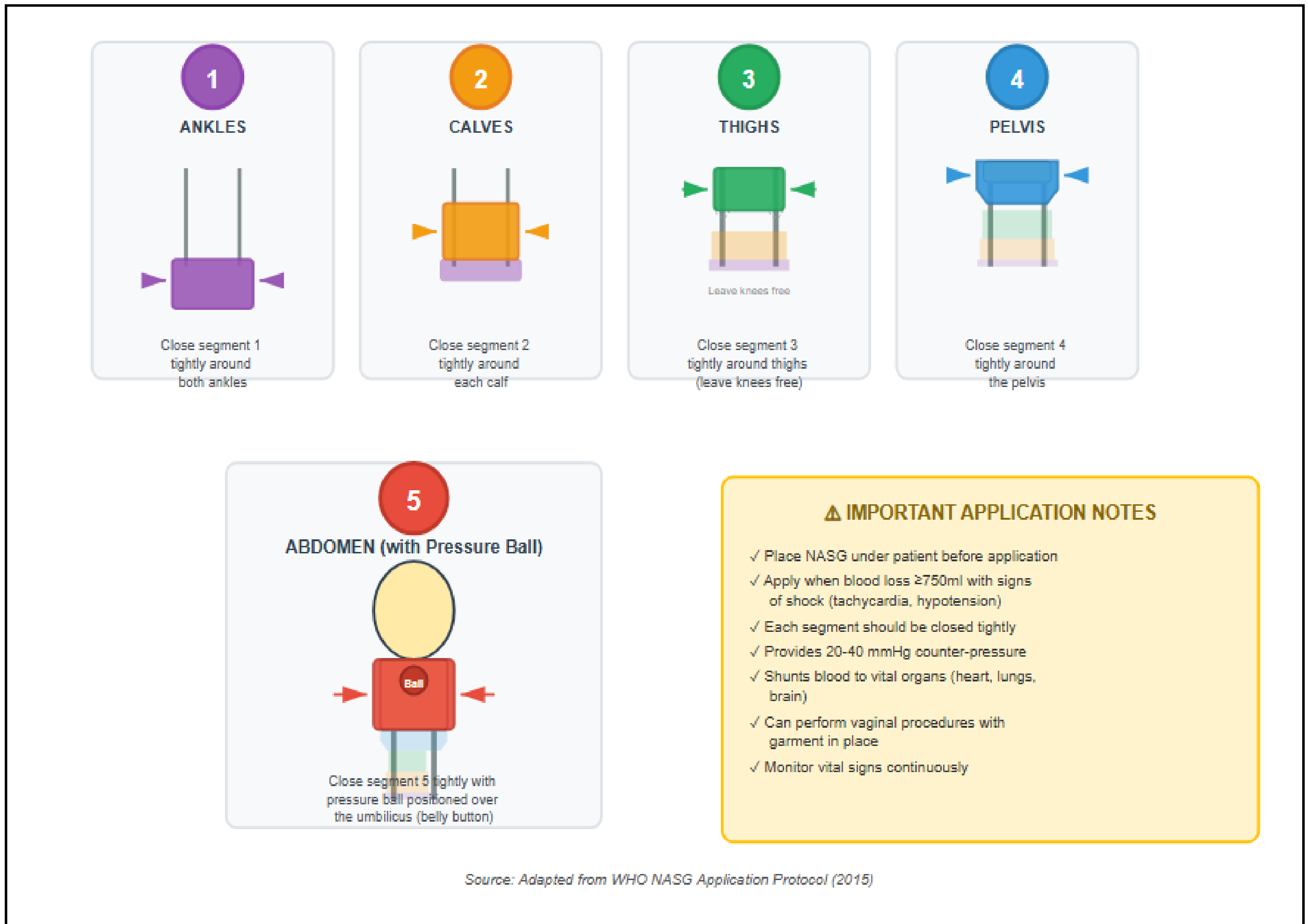

Fig 2 NASG Application Sequence

- *When to Apply:*

✓ At onset of PPH with estimated blood loss â‰¥750ml
✓ Presence of clinical shock signs (tachycardia, hypotension)
✓ During patient stabilization and transport
✓ While awaiting definitive surgical/medical intervention

- *Removal Protocol:*

NASG should only be removed when the woman has been hemodynamically stable for at least 2 hours with:

✓ Blood loss <50ml/hour
✓ Pulse <100 BPM
✓ Systolic BP >100 mmHg

Removal proceeds sequentially from ankles upward, allowing 15 minutes between each segment for blood redistribution, with continuous vital signs monitoring (Saxena, 2016).

➢ *Advantages and Limitations*

- *Advantages:*

✓ Costeffective and suitable for lowresource settings (ElAyadi et al., 2015)
✓ Reusable up to 40 times after proper decontamination
✓ Vaginal procedures can be performed with garment in place
✓ Abdominal surgeries possible by opening abdominal section
✓ Brief training required (Ojengbede et al., 2011)

- *Limitations:*

✓ One size does not fit all women
✓ Infection risk if not properly sterilized
✓ Limited availability in many healthcare facilities
✓ Requires training for correct application

➢ *Barriers to NASG ScaleUp*

Jordan, Butrick, Yamey, and Miller (2016) conducted interviews across Ethiopia, India, Nigeria, and Zimbabwe to assess NASG scaleup challenges. Key barriers identified included:

- Limited health infrastructure
- Relatively high upfront cost
- Initial resistance by providers and policymakers
- Lack of incountry champions
- Inadequate return and exchange programs
- Lack of political will

Facilitators included device simplicity, international champions, welldeveloped training sessions, WHO/FIGO

recommendations, and dissemination of clinical trial results.

➢ *Knowledge and Utilization Studies in Nigeria*

- *Bayelsa State Study (2015):*

Onasoga et al. (2015) assessed knowledge and utilization among midwives in Bayelsa State. Results showed that while most respondents had good knowledge of NASG and its usefulness, approximately half had never used it as it was not part of the PPH management protocol in their facilities.

- *Ibadan Study (2014):*

Kolade, Tijani, Oladeji, and Ajibade (2014) found average knowledge and utilization of antishock garment among midwives at University College Hospital, Ibadan. The study recommended continuous education and periodic training.

- *Lagos State Study (2017):*

Ogungbe (2017) reported that majority of midwives in teaching hospitals in Lagos State showed indifference towards NASG utilization, despite theoretical knowledge of the device.

These studies consistently highlight a gap between knowledge and actual utilization, emphasizing the need for systematic integration of NASG into PPH management protocols.

➢ *Theoretical Framework*

This study is grounded in Lydia Hall's CareCoreCure Theory (1960s), which consists of three interconnected circles:

- *CARE:*

The "motherly" care provided by midwives, including comfort measures, patient teaching, and meeting patient needs. In PPH management, this involves providing psychological support, comfortable positioning, and empathetic communication with patients and relatives.

- *CORE:*

The patient (woman experiencing PPH) and her goals. Through the closeness offered by intimate bodily care, the patient feels comfortable enough to accept help. In this context, the woman experiencing PPH receives NASG application to meet oxygenation and tissue perfusion needs, reversing shock through increased cardiac output and blood supply to vital organs.

- *CURE:*

Medical attention shared with physicians, including NASG application, continuous vital signs assessment, administration of prescribed medications and blood products, and surgical interventions as needed.

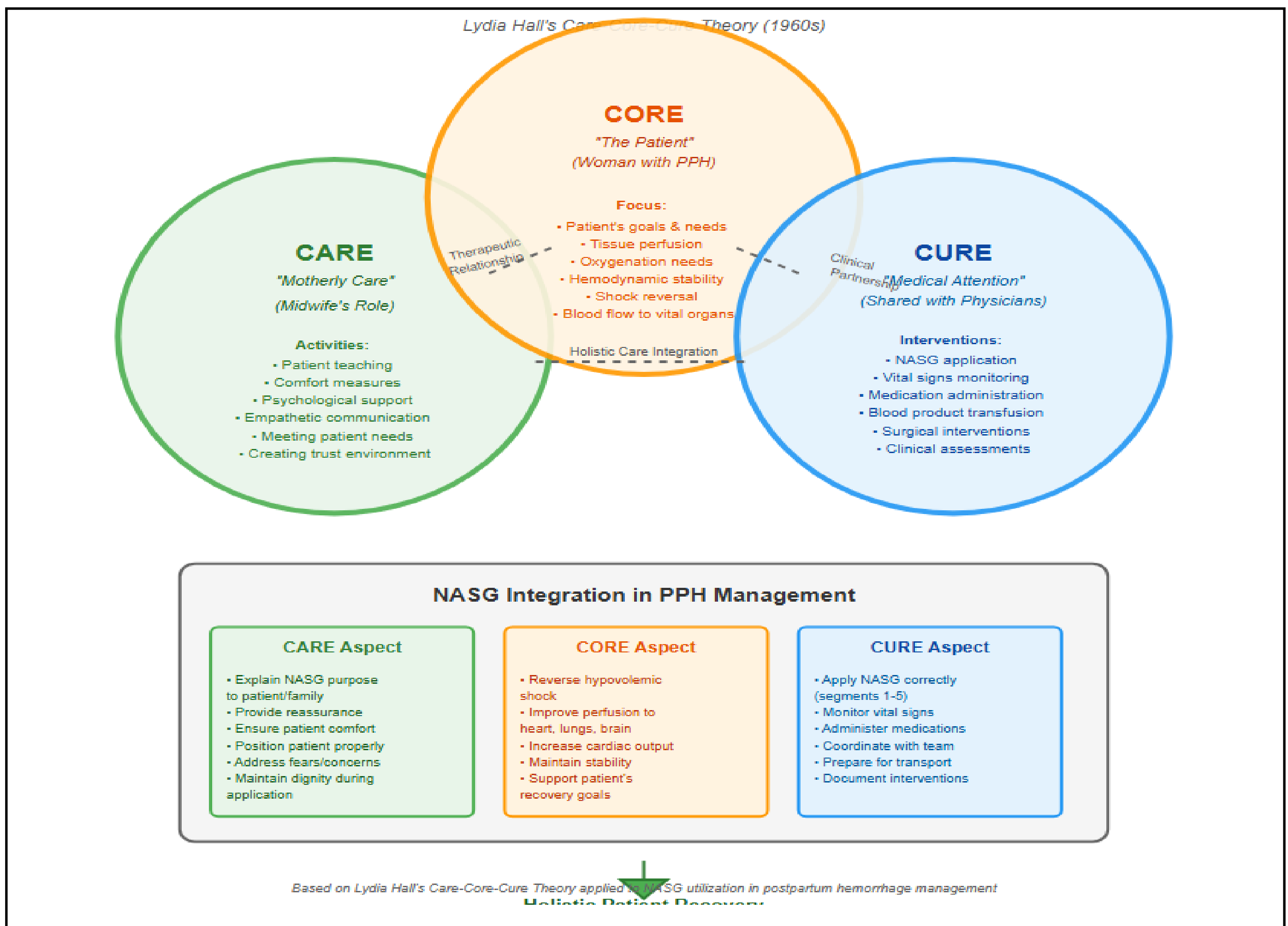

Fig 3 Application of CareCoreCure Theory to NASG Use in PPH Management

The theory emphasizes that through handson care (NASG application and monitoring), therapeutic relationships develop, creating an environment of comfort and trust that promotes rapid recovery and emergence of the patient as a whole person.

III. METHODOLOGY

➢ *Research Design*

A descriptive crosssectional research design was employed using a structured questionnaire to gather quantitative data describing midwives' knowledge, perception, attitude, and utilization of NASG in PPH management.

➢ *Study Setting*

The study was conducted in Remo area of Ogun State, SouthWestern Nigeria, focusing on two tertiary hospitals:

- *Babcock University Teaching Hospital (BUTH), IlishanRemo:*

A missionary owned hospital founded by the Seventhday Adventist Church in 1986, located at latitude 6Â°52'39.67"N and longitude 3Â°39'52.66"E. The hospital offers comprehensive obstetric and gynecological services, including emergency care, family planning, and specialized maternal health services.

- *Olabisi Onabanjo University Teaching Hospital (OOUTH), Sagamu:*

Established January 1, 1986, located at longitude 3.65425 and latitude 6.84861. The hospital provides tertiary healthcare services, training for medical students, and serves as a referral center for Ogun State and surrounding areas.

Both facilities serve diverse populations and handle significant obstetric emergencies, making them appropriate settings for assessing NASG utilization.

➢ *Target Population and Sampling*

- *Target Population:*

Licensed midwives at BUTH and OOUTH

✓ BUTH: 68 midwives
✓ OOUTH: 121 midwives
✓ Total population: 189 midwives

- Sample Size Determination:
- Using Taro Yamane's formula:

n = N / [1 + N(eÂ²)]

Where:

✓ n = sample size
✓ N = population size (189)
✓ e = level of significance (0.05)

n = 189 / [1 + 189(0.0025)]

n = 189 / 1.4725

n = 128.3

However, to account for potential nonresponse and ensure adequate representation, the sample was increased to 173 participants.

- *Sampling Technique:*

Proportional stratified random sampling was used to ensure representation from both hospitals:

✓ BUTH: (68/189) — 173 = 62 participants
✓ OOUTH: (121/189) — 173 = 111 participants

➢ *Instrument for Data Collection*

A structured selfadministered questionnaire was developed, consisting of four sections:

- *Section A:*

SocioDemographic Characteristics (9 items)

✓ Age, gender, ethnicity, religion
✓ Academic qualification, professional qualification
✓ Designation, years of experience, hospital

- *Section B:*

Knowledge on NASG Utilization (14 items)

✓ Dichotomous (Yes/No) questions
✓ Knowledge scoring: High (1114), Moderate (610), Low (15)

- *Section C:*

Perception towards NASG Utilization (6 items)

✓ Dichotomous scale (Yes=1, No=0)
✓ Items assessed perceived effectiveness, mortality reduction, and patient stabilization

- *Section D:*

Attitude towards NASG Utilization (6 items)

✓ 4point Likert scale: Strongly Agree to Strongly Disagree
✓ Items assessed beliefs about necessity, affordability, application difficulty, and effectiveness

- *Section E:*

Extent of NASG Utilization (11 items)

✓ 4point Likert scale measuring barriers to utilization
✓ Items covered availability, knowledge gaps, application challenges, and infrastructure issues

➢ *Validity and Reliability*

- *Validity:*

Face and content validity were established through expert review by the research supervisor and faculty members in the Department of Nursing Sciences, Babcock University. The instrument was refined based on feedback to ensure accurate measurement of study variables.

- *Reliability:*

A pilot study was conducted with 20 midwives at Federal Medical Centre Abeokuta (not included in the main study). Internal consistency was assessed using Cronbach's alpha:

Table 1 Reliability Results

S/N	Variables	Items	Cronbach's Alpha
1	Section B: Knowledge on the utilization of NASG	14	0.80
2	Section C: Perception towards the utilization of NASG	06	0.77
3	Section D: Attitudes towards the utilization of NASG	06	0.81
Total		26	0.86

➢ *Data Collection Procedure*

- Ethical approval obtained from Babcock University Health Research Ethics Committee (BUHREC)
- Permission letters secured from hospital management of both facilities
- Letters of introduction obtained from the Department of Nursing Sciences
- Two research assistants were trained on data collection procedures
- Participants were briefed on study purpose and voluntary participation
- Informed consent obtained from all participants
- Questionnaires selfadministered during break times and shift handovers
- Collection conducted over four visits (two weeks, 2 days per facility)
- Focal persons identified in each ward to facilitate questionnaire retrieval
- All 173 distributed questionnaires were retrieved and analyzed

➢ *Data Analysis*

Data were analyzed using Statistical Package for Social Sciences (SPSS) version 24.0. Analysis included:

- *Descriptive Statistics:*

✓ Frequency distributions and percentages for categorical variables
✓ Mean and standard deviation for continuous variables
✓ Weighted mean scores for Likertscale items

- *Inferential Statistics:*

✓ Pearson Product Moment Correlation (PPMC) to test associations between variables
✓ Hypotheses tested at 5% significance level (Î± = 0.05)

➢ *Ethical Considerations*

- Ethical approval obtained from BUHREC
- Informed consent secured from all participants
- Participation was voluntary with right to withdraw
- Anonymity and confidentiality maintained
- No personal identifiers collected
- Data stored securely and used solely for research purposes
- Results to be shared with participating institutions for policy development

IV. RESULTS

➢ *SocioDemographic Characteristics*

A total of 173 midwives participated in the study, with complete responses obtained from all participants (100% response rate).

Table 2 Respondents' Socio-Demographic Data

Age Distribution		
Age Group	**Frequency**	**Percentage (%)**
15–25 years	59	34.1
26–35 years	84	48.6
36–45 years	30	17.3
Total	173	100
Mean Age	27.9	SD = 8.81
Gender		
Gender	**Frequency**	**Percentage (%)**
Male	29	16.8
Female	144	83.2
Total	173	100
Ethnicity		
Ethnicity	**Frequency**	**Percentage (%)**
Hausa	11	6.4
Igbo	47	27.1
Yoruba	115	66.5
Total	173	100
Religion		
Religion	**Frequency**	**Percentage (%)**
Christianity	110	63.6
Islam	57	32.9
Traditionalist	4	2.3
Others	2	1.2
Total	173	100
Academic Qualification		
Qualification	**Frequency**	**Percentage (%)**
Diploma	17	9.8
BNSc	118	68.2
MSc	38	22.0
PhD	0	0
Total	173	100
Professional Qualification		
Qualification	**Frequency**	**Percentage (%)**
RN	5	2.9
RM	20	11.6
RN/RM	107	61.8
RPHN	23	13.3
RN/PON	18	10.4
Total	173	100
Designation		
Designation	**Frequency**	**Percentage (%)**
NO II	23	13.3
NO I	29	16.8
SNO	51	29.5
PNO	48	27.7
ACNO	17	9.8
CNO	5	2.9
Total	173	100
Work Experience		
Years of Experience	**Frequency**	**Percentage (%)**
1–10 years	104	60.1
11–20 years	54	31.2
21+ years	15	8.7
Total	173	100
Hospital		
Hospital	**Frequency**	**Percentage (%)**
BUTH	57	32.9
OOUTH	116	67.1
Total	173	100

- *Key Demographic Findings:*

✓ Mean age: 27.9 Â± 8.81 years, with 48.6% aged 2635 years
✓ Female predominance (83.2%)
✓ Yoruba ethnic majority (66.5%)
✓ Christian majority (63.6%)
✓ Most held BNSc degree (68.2%) and RN/RM qualification (61.8%)
✓ Majority were SNO (29.5%) or PNO (27.7%) designation
✓ Most had 110 years work experience (60.1%)

➢ *Knowledge of Midwives on NASG Utilization*

- *Research Question 1:*

What is the level of knowledge of midwives on the utilization of NASG in the management of postpartum hemorrhage?

Table 3 (a): Knowledge of Midwives on the Utilization of NASG (N = 173)

Item	Yes (%)	No (%)
Heard of NASG	173 (100%)	0
Ever seen NASG	111 (64.2%)	62 (35.8%)
First heard from hospital	57 (32.9%)	–
First heard from school	51 (29.5%)	–
First heard from seminar	65 (37.6%)	–
Know what NASG is used for	97 (56.1%)	76 (43.9%)
Material (Rubber)	81 (46.8%)	–
Material (Neoprene)	92 (53.2%)	–
Parts = Five	90 (52.0%)	–
Parts = Six	44 (25.4%)	–
Parts = Eight	39 (22.6%)	–
NASG is first aid for PPH	81 (46.8%)	92 (53.2%)
Works by forcing blood upward	73 (42.2%)	100 (57.8%)
Keeps patient alive during transport	90 (52.0%)	83 (48.0%)
Can be used in shock	88 (50.9%)	85 (49.1%)
Causes discomfort	70 (40.5%)	103 (59.5%)
Translocates 1.5–2L blood	109 (63.0%)	64 (37.0%)
Inflatable device (incorrect belief)	85 (49.1%)	88 (50.9%)

- *Knowledge Level Classification:*

Table 3 (b): Summary of Knowledge Levels

Level	Frequency	%
Poor	32	18.5
Average/Moderate	88	50.9
High	53	30.6
Total = 173 (100%)		
Mean score = 6.609 (50.8%)		
SD = 2.112		

- *Key Findings:*

✓ All participants (100%) had heard of NASG
✓ Only 64.2% had actually seen the device
✓ Mean knowledge score: 6.609 (50.8%) indicating moderate knowledge
✓ Half of respondents (50.9%) demonstrated moderate knowledge
✓ Only 30.6% had high knowledge levels
✓ Main information sources: Seminars (37.6%), Hospital (32.9%), School (29.5%)

➢ *Perception of Midwives towards NASG Utilization*

- *Research Question 2:*

What is the perception of midwives towards the utilization of nonpneumatic antishock garment in the management of postpartum hemorrhage?

Table 4 Perception of Midwives Toward Utilization of NASG (N = 173)

Item	Yes (%)	No (%)
NASG is effective when promptly used	94 (54.3%)	79 (45.7%)
NASG reduces surgery	82 (47.4%)	91 (52.6%)
Reduces morbidity/mortality	96 (55.5%)	77 (44.5%)
Keeps patient alive during transport	91 (52.6%)	82 (47.4%)
Stabilizes patient while diagnosing cause	105 (60.7%)	66 (39.3%)

- *Key Findings:*

- ✓ Average positive perception (55.4%)
- ✓ Highest agreement: Blood translocation mechanism (63.0%)
- ✓ Lowest agreement: Reduces surgery rates (47.4%)
- ✓ Moderate overall perception towards NASG effectiveness

➢ *Attitude of Midwives towards NASG Utilization*

- *Research Question 3:*

What is the attitude of midwives towards the utilization of NASG?

Table 5 Attitudes of Midwives Toward the Utilization of NASG (N = 173)

Variable	SA (%)	A (%)	D (%)	SD (%)	Mean
Use unnecessary where blood transfusion exists	31 (19.9)	48 (27.7)	43 (24.9)	51 (29.5)	2.13
No need for garment (not affordable)	23 (13.3)	55 (31.8)	43 (24.9)	50 (28.9)	2.10
Application/removal takes time	35 (20.2)	56 (32.4)	74 (42.8)	8 (4.6)	2.38
Can transmit HIV	74 (42.8)	8 (4.6)	44 (25.4)	47 (27.2)	2.08
Only beneficial in rural areas	48 (27.7)	20 (11.6)	55 (31.8)	50 (28.9)	2.05
Ineffective for cervical lacerations	28 (16.2)	66 (38.2)	53 (30.6)	26 (15.0)	2.44

Weighted mean = 2.21

- ✓ Note: SA=Strongly Agree, A=Agree, D=Disagree, SD=Strongly Disagree; Scale: 14

- *Key Findings:*

- ✓ Overall attitude was fair (mean = 2.21 on 4point scale)
- ✓ Most negative attitudes: HIV transmission concerns, ruralonly perception
- ✓ Most positive attitudes: Recognition of effectiveness despite procedural complexity
- ✓ Mixed attitudes indicate need for attitude change interventions

➢ *Extent of NASG Utilization*

- *Research Question 4:*

To what extent do midwives use NASG in the management of postpartum hemorrhage?

Table 6 Extent of NASG Use in Managing PPH (N = 173)

Variable	Agree (%)	Disagree (%)	Mean	Rank
Non-availability prevents use	127 (73.4)	46 (26.6)	2.71	2nd
NASG not enough	133 (76.9)	40 (23.1)	2.94	1st
Don't know how to use	87 (50.3)	86 (49.7)	2.01	11th
Takes long to apply	93 (53.8)	80 (46.2)	2.27	8th
Not functional	88 (50.9)	85 (49.1)	2.03	10th
Difficult to apply	100 (57.8)	73 (42.2)	2.33	7th
Application takes time	107 (61.8)	66 (38.2)	2.59	6th
Inexperienced workers	93 (53.8)	80 (46.2)	2.27	8th
Lack of skilled personnel	109 (63.0)	64 (37.0)	2.63	5th
One size not fit all women	110 (63.6)	63 (36.4)	2.67	4th
Infection risk if not sterilized	117 (67.6)	56 (32.4)	2.69	3rd

Weighted mean score of non-use = 2.47 (61.8%)

- *Key Findings:*

- ✓ Nonutilization rate: 61.8% (above average)
- ✓ Top 3 barriers:

- Inadequate supply (76.9%)
- Nonavailability (73.4%)
- Infection risk concerns (67.6%)

- ✓ Least barrier: Lack of knowledge on how to use (50.3%)
- ✓ Infrastructure and supply issues predominate over knowledge gaps

4.6 Hypothesis Testing

- *Hypothesis 1:*

There is no significant association between the knowledge of midwives and the utilization of NASG in the control of postpartum hemorrhage.

Table 7: Correlation between Knowledge and NASG Utilization]

Table 7 Pearson Correlation Coefficients

Pair	Correlation (r)	p-value	N
Knowledge ↔ Utilization	−0.612**	.000	173

(** significant at 0.01 level)

- ✓ Note: Correlation is significant at the 0.01 level (2tailed)

- *Result:*

The null hypothesis was rejected. There is a statistically significant inverse relationship between knowledge and utilization ($r = 0.612$, $p < 0.001$). This paradoxical finding suggests that despite having knowledge about NASG, midwives are not utilizing it, likely due to external barriers (availability, infrastructure) rather than knowledge deficits.

- *Hypothesis 2:*

There is no significant association between the attitude of midwives and the utilization of NASG in the control of postpartum hemorrhage.

Table 8 Correlation between Attitude and NASG Utilization]

Table 8 Pearson Correlation Coefficients

Pair	Correlation (r)	p-value	N
Attitude ↔ Utilization	0.346**	.000	173

(** significant at 0.01 level)

- ✓ Note: Correlation is significant at the 0.01 level (2tailed)

- *Result:*

The null hypothesis was rejected. There is a statistically significant positive relationship between attitude and utilization ($r = 0.346$, $p < 0.001$). More positive attitudes towards NASG are associated with higher utilization intentions, though actual utilization remains constrained by external barriers.

DISCUSSION

➢ *Knowledge of Midwives on NASG Utilization*

This study found that midwives demonstrated moderate knowledge (mean score: 6.609, 50.8%) regarding NASG utilization in PPH management. While all participants (100%) had heard of NASG, only 64.2% had actually seen the device, and knowledge of specific operational details was limited.

These findings align with previous Nigerian studies. Onasoga et al. (2015) in Bayelsa State reported that while most midwives had good theoretical knowledge of NASG, approximately half had never used it as it was not part of institutional PPH protocols. Similarly, Kolade et al. (2014) found average knowledge among midwives at University College Hospital, Ibadan.

The moderate knowledge level, despite 100% awareness, suggests a theorypractice gap. Midwives possess conceptual understanding but lack practical experience and procedural competency. This gap likely results from:

- Limited handson training opportunities: Knowledge acquired through seminars (37.6%) and classroom education (29.5%) without practical application
- Absence of NASG in protocols: Devices not integrated into standard PPH management guidelines in many facilities
- Insufficient continuing education: Lack of regular refresher training on NASG application and removal

The finding that 56.1% knew NASG's purpose while only 52% understood its mechanism of action indicates superficial rather than comprehensive knowledge. For effective utilization, midwives need detailed understanding of:

- ✓ Physiological mechanism (counterpressure and blood shunting)
- ✓ Proper application sequence
- ✓ Monitoring requirements
- ✓ Safe removal protocols
- ✓ Contraindications and complications

These results support the conclusion of Olowokere et al. (2013) that despite NASG's proven efficacy, underutilization persists in developing countries due to inadequate training and knowledge translation gaps.

➢ *Perception of Midwives Towards NASG Utilization*

Midwives demonstrated average positive perception (55.4%) towards NASG utilization. The highest agreement was on NASG's ability to translocate blood to vital organs (63.0%) and stabilize patients while identifying bleeding sources (60.7%). However, only 47.4% believed NASG reduces surgical intervention rates.

These perceptions reflect partial understanding of NASG's clinical benefits. Evidence from multiple studies demonstrates that NASG:

- Reduces emergency hysterectomy by 56% (Miller et al., 2016)
- Decreases severe morbidity by 81% (Miller et al., 2016)
- Cuts mortality rates by 44% (MouradYoussif et al., 2010)
- Reduces blood loss by 50% (Escobar et al., 2017)

The moderate perception scores suggest that midwives have not fully appreciated NASG's comprehensive benefits, possibly due to:

- Limited exposure to successful cases: Without witnessing NASG's effectiveness firsthand, midwives rely on theoretical knowledge
- Skepticism about device efficacy: Cultural preference for established treatments (blood transfusion, surgery) over newer technologies
- Incomplete information dissemination: Research findings not effectively communicated to frontline healthcare workers

Ogungbe's (2017) Lagos State study similarly found indifference towards NASG utilization among midwives, reinforcing that perception gaps persist across Nigerian healthcare settings.

- *Improving Perceptions Requires:*

✓ Case study presentations demonstrating NASG outcomes
✓ Peertopeer learning from facilities successfully using NASG
✓ Integration of NASG success stories into professional development programs
✓ Evidencebased educational materials highlighting clinical benefits

➢ *Attitude of Midwives Towards NASG Utilization*

The study revealed fair attitudes (mean = 2.21 on 4point scale) among midwives towards NASG utilization. Notable attitude patterns included:

- *Negative Attitudes:*

✓ 42.8% strongly agreed NASG can transmit HIV
✓ 38.7% believed NASG is only beneficial in rural/primary care settings
✓ 45.6% considered NASG unnecessary where blood transfusion is available

- *Positive Attitudes:*

✓ 54.3% disagreed that NASG application is overly complex
✓ 57.7% recognized NASG's effectiveness despite procedural requirements

The HIV transmission concern (42.8%) represents a significant misconception requiring urgent correction. NASG, when properly cleaned and decontaminated according to manufacturer guidelines, poses no infectious disease transmission risk. Each garment is reusable up to 40 times with appropriate sterilization (Ojengbede et al., 2011).

The belief that NASG is "only for rural areas" (38.7%) undermines its potential in tertiary facilities. This attitude may stem from:

✓ Perception that tertiary hospitals have adequate resources (blood banks, surgical capacity) making NASG unnecessary
✓ Misconception that NASG is a "lowtech" solution for resourcepoor settings
✓ Lack of understanding that even in wellequipped facilities, NASG provides stabilization during treatment delays

These findings parallel Ogbeye et al.'s (2015) Ondo State study, which found no significant association between midwives' attitudes and NASG utilization, suggesting systemic rather than individual attitudinal barriers.

- *Attitude Change Strategies:*

✓ Address misconceptions through evidencebased education
✓ Demonstrate NASG use in tertiary settings
✓ Provide proper infection control training
✓ Share success stories from diverse healthcare levels
✓ Incorporate NASG into institutional policies and protocols

➢ *Extent of NASG Utilization and Barriers*

The study revealed suboptimal utilization (61.8% nonusage rate) despite moderate knowledge. The top three barriers were:

- Inadequate supply (76.9%)
- Nonavailability (73.4%)
- Infection risk concerns (67.6%)

Notably, "lack of knowledge on how to use" ranked lowest (50.3%), indicating that systemic infrastructure problems rather than individual knowledge deficits drive underutilization.

These findings corroborate Sharma et al.'s (2016) observation that healthcare workers fail to use NASG primarily due to facilitylevel factors: equipment unavailability, inadequate supply, and insufficient infrastructure support.

- *Supply and Availability Challenges:*

The high prevalence of availability issues reflects broader problems in Nigeria's healthcare system:

✓ Procurement challenges: High upfront costs (approximately $200300 USD per garment) limit institutional investment
✓ Supply chain weaknesses: Inadequate distribution networks for medical devices
✓ Maintenance gaps: Existing garments may be nonfunctional due to poor maintenance
✓ Inventory management: Lack of systematic stock monitoring and replenishment

- *Jordan et al.'s (2016) Multicountry Study Identified Similar Barriers to NASG Scaleup:*

- ✓ Limited health infrastructure
- ✓ Relatively high costs
- ✓ Lack of incountry champions
- ✓ Inadequate exchange programs
- ✓ Insufficient political will

- *Infection Control Concerns:*

The high ranking of infection risk (67.6%) highlights inadequate training on proper decontamination protocols. WHO guidelines specify that NASG requires:

- ✓ Immediate cleaning after each use
- ✓ Disinfection with appropriate solutions
- ✓ Proper drying and storage
- ✓ Regular inspection for damage
- ✓ Documentation of usage cycles (maximum 40 uses per garment)

- *Many Facilities Lack:*

- ✓ Designated NASG cleaning areas
- ✓ Appropriate disinfectant solutions
- ✓ Staff trained in decontamination procedures
- ✓ Standard operating procedures for reprocessing

➢ *Implications for Policy and Practice:*

- *Institutional Investment:*

- ✓ Allocate budget for NASG procurement
- ✓ Establish minimum stock levels (at least 23 garments per labor ward)
- ✓ Create replacement schedules

- *Infrastructure Development:*

- ✓ Designate storage areas for NASG
- ✓ Establish cleaning and decontamination protocols
- ✓ Provide necessary cleaning supplies

- *Human Resource Development:*

- ✓ Conduct handson training for all midwives
- ✓ Include NASG in new staff orientation
- ✓ Schedule regular refresher training

- *Policy Integration:*

- ✓ Incorporate NASG into PPH management protocols
- ✓ Develop institutional guidelines for application and removal
- ✓ Mandate NASG use for eligible PPH cases

➢ *KnowledgeUtilization Paradox*

The study revealed a significant inverse relationship between knowledge and utilization (r = 0.612, p < 0.001). This paradoxical findingâ€”where higher knowledge correlates with lower utilizationâ€”requires careful interpretation.

- *Possible Explanations:*

✓ *Availability Constraints Override Knowledge:*

Midwives with better NASG knowledge may be more aware of its absence in their facilities, leading to frustration and resignation. Conversely, those with less knowledge may overestimate actual utilization.

✓ *Knowledge Without Access:*

Theoretical knowledge gained through seminars and education creates awareness of NASG's benefits, but facility constraints prevent practical application, resulting in the inverse correlation.

✓ *Critical Awareness Effect:*

Betterinformed midwives may be more critical of inadequate NASG supplies, infrastructure deficits, and protocol gaps, leading to realistic (lower) utilization reporting.

✓ *Measurement Artifact:*

The utilization measure may reflect attempted use rather than successful use. Knowledgeable midwives may attempt NASG application but encounter availability or infrastructure barriers.

This finding diverges from typical knowledgepractice relationships where knowledge positively predicts utilization. However, it aligns with socioecological models recognizing that individual knowledge operates within broader organizational and systemic contexts.

- *Similar Findings:*

Kolade et al. (2014) in Ibadan found that despite average knowledge, utilization remained suboptimal due to noninclusion in institutional protocols. The inverse relationship suggests that systemlevel interventions (ensuring availability, integrating into protocols, providing infrastructure) are more critical than individuallevel knowledge enhancement.

➢ *AttitudeUtilization Relationship*

A significant positive relationship (r = 0.346, p < 0.001) was found between attitude and utilization, indicating that more positive attitudes associate with higher utilization intentions.

This aligns with health behavior theories (Theory of Planned Behavior, Health Belief Model) positing that attitudes influence behavioral intentions and, when enabling factors exist, actual behaviors.

However, the moderate correlation coefficient (r = 0.346) suggests that attitude explains only ~12% of utilization variance (rÂ² = 0.12), indicating that external factors (availability, infrastructure) exert stronger influence than individual attitudes.

- *Practical Implications:*

While attitude improvement through education and awareness campaigns is valuable, it must be coupled with:

- ✓ Equipment availability
- ✓ Supportive institutional policies
- ✓ Adequate infrastructure
- ✓ Enabling environment for NASG use

Attitude change alone, without addressing systemic barriers, will have limited impact on utilization rates.

➢ *Theoretical Framework Application*

Lydia Hall's CareCoreCure Theory effectively guided this study's understanding of midwives' role in NASG utilization:

- *CARE Component:*

Midwives provide compassionate, skilled care through NASG application, creating therapeutic relationships that facilitate patient comfort and recovery. The study found that midwives recognize this caring role (perception scores) but face barriers preventing its full expression.

- *CORE Component:*

The woman experiencing PPH is central, with NASG meeting her physiological needs (oxygenation, tissue perfusion). The study revealed that while midwives understand this patientcentered goal (knowledge), system failures prevent them from achieving it (utilization barriers).

- *CURE Component:*

NASG represents a collaborative medical intervention alongside pharmaceutical and surgical treatments. The study demonstrated that midwives view NASG as complementary rather than standalone treatment (perception findings), though inadequate integration into comprehensive PPH protocols limits its curative potential.

The theory's emphasis on interconnected circles resonates with study findings: optimal NASG utilization requires alignment of all three componentsâ€"caring midwives (CARE), available resources (enabling CURE), and patient needs (CORE). Current system deficiencies in the CURE circle (equipment availability, institutional support) disrupt the entire triad.

➢ *Comparison with International Evidence*

- *ScaleUp Experiences:*

Jordan et al.'s (2016) analysis of NASG scaleup in Ethiopia, India, Nigeria, and Zimbabwe identified common facilitators and barriers:

- *Facilitators:*

- ✓ Device simplicity (corroborated by current study: 49.7% found it not difficult to use)
- ✓ International champion advocacy
- ✓ WHO/FIGO recommendations
- ✓ Clinical trial evidence dissemination

- *Barriers:*

- ✓ Limited infrastructure (current study: 7377% availability issues)
- ✓ High upfront costs
- ✓ Resistance from providers/policymakers
- ✓ Lack of national champions
- ✓ Inadequate political will

- *Clinical Effectiveness:*

Current study findings align with international clinical evidence:

The consistency of clinical benefits across diverse settings underscores NASG's effectiveness, while persistent utilization gaps highlight implementation challenges.

➢ *Implications for Maternal Mortality Reduction*

Nigeria's maternal mortality ratio remains among the world's highest (814 per 100,000 live births in 2024 estimates), with PPH contributing 2534.7% of deaths (WHO, 2015; Agida, 2010; Kullami et al., 2015).

- *NASG's Potential Impact:*

If NASG were optimally utilized in Nigerian healthcare facilities, based on evidence from Miller et al. (2016) and MouradYoussif et al. (2010):

- ✓ 44% mortality reduction from PPH
- ✓ 50% decrease in blood loss
- ✓ 56% reduction in emergency hysterectomies
- ✓ 81% decrease in severe morbidities

- *Projected Lives Saved:*

Assuming PPH contributes 30% of Nigeria's ~40,000 annual maternal deaths (12,000 PPH deaths), and NASG achieves 44% mortality reduction:

- ✓ Potential lives saved annually: 5,280 women
- ✓ Potential morbidity reductions: ~10,000 cases annually

These projections underscore the urgency of addressing NASG utilization barriers as a maternal mortality reduction strategy.

➢ *Study Limitations*

Several limitations should be considered when interpreting findings:

- *Geographic Limitation:*

The study focused on two hospitals in Ogun State, limiting generalizability to other Nigerian regions with different healthcare infrastructure, resources, and populations.

- *CrossSectional Design:*

Data collected at a single time point cannot establish causality or capture temporal changes in knowledge, attitudes, and practices.

- *SelfReport Bias:*
  Questionnaire responses may be subject to:

- ✓ Social desirability bias (overreporting knowledge/positive attitudes)
- ✓ Recall bias (inaccurate memory of NASG encounters)
- ✓ Acquiescence bias (tendency to agree with statements)

- *Actual vs. Reported Utilization:*
  The study assessed selfreported utilization rather than observing actual NASG application in clinical settings. Reported rates may not reflect real practice.

- *Limited Qualitative Data:*
  The quantitative approach, while providing statistical rigor, lacks deep exploration of:

- ✓ Contextual factors influencing utilization
- ✓ Personal experiences with NASG
- ✓ Institutional culture and norms
- ✓ Interpersonal dynamics affecting practice

- *Instrument Limitations:*
  Despite validation, the questionnaire may not capture all nuances of knowledge (e.g., procedural competency vs. declarative knowledge) and attitudes (e.g., implicit biases).

- *Sampling Considerations:*
  While proportional stratified random sampling ensured representation, the focus on tertiary hospitals may not reflect primary and secondary healthcare levels where NASG might have greatest impact.

- *Temporal Context:*
  Data collected in 2020 during early COVID19 pandemic may reflect unique circumstances affecting healthcare delivery, resource allocation, and priorities.

Despite these limitations, the study provides valuable insights into NASG utilization barriers in Nigerian tertiary hospitals and informs targeted interventions.

V. CONCLUSION

This study assessed the utilization of NonPneumatic AntiShock Garment (NASG) in postpartum hemorrhage management among midwives in selected Ogun State hospitals. Key conclusions include:

➢ *Principal Findings*

- *Moderate Knowledge:*
  Midwives demonstrated moderate knowledge (50.8%) about NASG, with all participants aware of the device but only 64.2% having seen it. Knowledge gaps existed regarding specific operational details and mechanisms of action.

- *Average Perception:*
  Midwives held average positive perceptions (55.4%) towards NASG effectiveness, recognizing its stabilization capabilities but underappreciating its full clinical benefits, particularly surgical intervention reduction.

- *Fair Attitudes:*
  Attitudes were fair (mean = 2.21/4.0), with concerning misconceptions including HIV transmission fears (42.8%) and perception of NASG as ruralonly technology (38.7%).

- *Suboptimal Utilization:*
  Despite moderate knowledge, NASG utilization remained low (61.8% nonusage rate), primarily due to:

- ✓ Inadequate supply (76.9%)
- ✓ Nonavailability (73.4%)
- ✓ Infection control concerns (67.6%)

- *KnowledgeUtilization Paradox:*
  A significant inverse relationship (r = 0.612) between knowledge and utilization revealed that systemic barriers override individual knowledge in determining practice patterns.

- *AttitudeUtilization Relationship:*
  Positive attitudes correlated with utilization (r = 0.346), though external factors exerted stronger influence than individual attitudes.

➢ *Contribution to Knowledge*

This study contributes to the limited body of Nigerian research on NASG utilization, specifically:

- *Empirical Evidence:*
  Provides quantitative data on knowledge, perception, and attitude patterns among Nigerian midwives regarding NASG.

- *Barrier Identification:*
  Systematically identifies and ranks barriers to NASG utilization, distinguishing between knowledgebased and infrastructurebased constraints.

- *Theoretical Application:*
  Applies Lydia Hall's CareCoreCure Theory to maternal health technology adoption, demonstrating how system failures disrupt the carecorecure triad.

- *PolicyRelevant Insights:*
  Offers evidencebased recommendations for addressing NASG underutilization through multilevel interventions.

➢ *Critical Insights*

- *The KnowledgePractice Gap:*
  This study underscores that knowledge alone is insufficient for practice change. Even when healthcare providers understand a lifesaving technology, systemic barriersâ€"inadequate supplies, infrastructure deficits, unsupportive policiesâ€"prevent translation of knowledge into practice. This finding challenges purely educational approaches to improving maternal health outcomes,

advocating instead for comprehensive system strengthening.

- *Infrastructure as the Critical Bottleneck:*

The predominance of availability and supply issues (7377% of respondents) over knowledge deficits (50.3%) in explaining underutilization highlights that infrastructure development must precede or accompany educational interventions. Investing in midwife training without ensuring NASG availability wastes resources and generates provider frustration.

- *The Importance of Evidence Dissemination:*

Misconceptions (HIV transmission, ruralonly applicability) persist despite extensive international evidence of NASG safety and effectiveness across all healthcare levels. This suggests that research findings are not effectively reaching frontline healthcare workers, necessitating improved knowledge translation strategies.

➢ *Public Health Significance*

With postpartum hemorrhage causing 2534.7% of maternal deaths in Nigeria, and NASG capable of reducing PPH mortality by 44%, the potential public health impact of optimal NASG utilization is substantial. The current underutilization represents missed opportunities to save thousands of women's lives annually.

- *Moreover, NASG Offers Particular Advantages in Nigerian Context:*

✓ Affordability: Lower cost than repeated blood transfusions, surgical interventions
✓ Accessibility: Applicable in primary, secondary, and tertiary facilities
✓ Transportability: Stabilizes patients during referral, addressing delayrelated deaths
✓ Simplicity: Trainable in brief periods, operable by diverse cadres

- *Maximizing NASG's Lifesaving Potential Aligns with:*

✓ Sustainable Development Goal 3.1: Reduce global maternal mortality ratio to <70 per 100,000 live births by 2030
✓ National Health Policy Priorities: Improving maternal health indicators
✓ Midwifery Scope of Practice: Empowering midwives with effective emergency interventions

➢ *Implications for Stakeholders*

- *For Hospital Management:*

✓ Allocate budgets for NASG procurement and maintenance
✓ Integrate NASG into PPH management protocols
✓ Establish inventory monitoring systems
✓ Provide infrastructure for proper decontamination

- *For Nursing/Midwifery Councils:*

✓ Include NASG in preservice midwifery curricula
✓ Mandate NASG competency for midwifery licensure renewal
✓ Develop standardized training programs and certification

- *For Government/Policymakers:*

✓ Subsidize NASG costs for public healthcare facilities
✓ Establish national distribution systems
✓ Include NASG in essential medical equipment lists
✓ Support research and monitoring of NASG outcomes

- *For Professional Associations:*

✓ Advocate for NASG availability and utilization
✓ Organize continuing professional development on NASG
✓ Facilitate peer learning and experience sharing
✓ Champion policy changes supporting NASG integration

- *For International Development Partners:*

✓ Fund NASG procurement for resourcelimited facilities
✓ Support training and capacity building programs
✓ Finance operations research on NASG implementation
✓ Facilitate SouthSouth learning exchanges

➢ *Call to Action*

Addressing Nigeria's maternal mortality crisis requires multifaceted strategies, and NASG represents a proven, costeffective intervention that remains underutilized. This study's findings demand urgent action:

- *Immediate:*

Conduct NASG availability assessments across Nigerian healthcare facilities and address critical supply gaps

- *Shortterm:*

Implement intensive handson training programs for midwives in all healthcare levels

- *Mediumterm:*

Integrate NASG into national and institutional PPH management guidelines and protocols

- *Longterm:*

Establish sustainable procurement, maintenance, and monitoring systems ensuring continuous NASG availability

Every woman experiencing postpartum hemorrhage deserves access to evidencebased, lifesaving interventions. The gap between NASG's proven efficacy and its actual utilization represents an ethical imperative for health system strengthening. Midwives, as frontline maternal health providers, must be equipped with knowledge, positive attitudes, andâ€”criticallyâ€”the

resources necessary to translate their caring intentions into lifesaving actions.

RECOMMENDATIONS

Based on study findings, the following recommendations are proposed:

➢ *For Healthcare Facility Management*

- *Ensure NASG Availability:*

✓ Procure adequate NASG supplies (minimum 23 per labor ward)
✓ Establish regular inventory monitoring and restocking systems
✓ Create designated storage areas with proper environmental conditions
✓ Develop equipment maintenance schedules

- *Integrate NASG into Protocols:*

✓ Include NASG in institutional PPH management guidelines
✓ Develop standard operating procedures for application and removal
✓ Create algorithms/flowcharts for when to apply NASG
✓ Mandate NASG use documentation in patient records

- *Provide Infrastructure Support:*

✓ Designate NASG cleaning and decontamination areas
✓ Supply appropriate disinfectants and cleaning materials
✓ Establish reprocessing protocols aligned with manufacturer guidelines
✓ Provide personal protective equipment for staff handling NASG

- *Foster Supportive Culture:*

✓ Recognize and reward midwives effectively using NASG
✓ Share success stories and positive outcomes
✓ Address concerns and misconceptions through evidencebased information
✓ Create feedback mechanisms for continuous improvement

➢ *For Educational Institutions and Training Programs*

- *PreService Education:*

✓ Incorporate NASG into midwifery and nursing curricula
✓ Include handson NASG application in clinical skills training
✓ Provide supervised practice opportunities during clinical rotations
✓ Assess NASG competency in clinical examinations

- *InService Training:*

✓ Conduct regular NASG workshops and simulation drills
✓ Provide competencybased training with skill demonstrations
✓ Use standardized training materials and videos
✓ Issue certificates for NASG proficiency

- *Continuing Professional Development:*

✓ Offer periodic refresher courses (annually or biannually)
✓ Include NASG in emergency obstetric care training programs
✓ Provide online learning modules for flexible access
✓ Organize interfacility learning exchanges

- *Address Knowledge Gaps:*

✓ Focus on mechanism of action, not just procedural steps
✓ Clarify indications, contraindications, and complications
✓ Train on proper removal protocols and monitoring requirements
✓ Educate on infection prevention and control measures

➢ *For Professional Regulatory Bodies*

- *Nursing and Midwifery Council of Nigeria (NMCN):*

✓ Include NASG competency in midwifery scope of practice
✓ Require NASG training for licensure renewal
✓ Develop national NASG training standards and curricula
✓ Accredit NASG training programs for quality assurance

- *Professional Associations:*

✓ Society of Gynaecology and Obstetrics of Nigeria (SOGON)
✓ National Association of Nigeria Nurses and Midwives (NANNM)
✓ Advocate for NASG availability in all maternity facilities
✓ Organize conferences and workshops highlighting NASG evidence
✓ Publish position statements supporting NASG utilization
✓ Facilitate research on NASG outcomes in Nigerian context

➢ *For Government and Health Ministries*

- *Policy Development:*

✓ Include NASG in National Guidelines for Quality Obstetric and Newborn Care

- ✓ Add NASG to Essential Medical Equipment List for all healthcare levels
- ✓ Integrate NASG into Maternal Death Surveillance and Response (MDSR) protocols
- ✓ Develop key performance indicators for NASG availability and utilization

- *Financing and Procurement:*

- ✓ Allocate dedicated budgets for NASG procurement in public facilities
- ✓ Negotiate bulk purchasing agreements to reduce costs
- ✓ Establish central warehousing and distribution systems
- ✓ Subsidize NASG costs for resourcelimited facilities

- *Monitoring and Evaluation:*

- ✓ Include NASG indicators in routine health information systems
- ✓ Conduct regular facility assessments of NASG availability and functionality
- ✓ Track NASG utilization rates and outcomes
- ✓ Commission operations research on implementation effectiveness

- *Multisectoral Collaboration:*

- ✓ Engage development partners in NASG scaleup initiatives
- ✓ Partner with manufacturers for technology transfer and local production
- ✓ Collaborate with academic institutions for research and evaluation
- ✓ Work with community organizations for demand generation

➢ *For Researchers*

- *Implementation Science:*

- ✓ Conduct mixedmethods studies exploring contextual factors affecting NASG utilization
- ✓ Evaluate different implementation strategies (training models, policy approaches)
- ✓ Assess sustainability of NASG programs over time
- ✓ Identify facilitators and barriers at multiple health system levels

- *Clinical Effectiveness:*

- ✓ Document clinical outcomes (morbidity, mortality) associated with NASG use in Nigerian facilities
- ✓ Compare outcomes between facilities with and without NASG availability
- ✓ Assess costeffectiveness of NASG relative to alternative interventions
- ✓ Examine longterm maternal and neonatal outcomes

- *Equity and Access:*

- ✓ Investigate disparities in NASG availability and utilization across facility types and regions
- ✓ Examine how NASG access affects outcomes for vulnerable populations
- ✓ Assess communitylevel factors influencing NASG acceptance and use

- *ScaleUp Research:*

- ✓ Document lessons learned from successful NASG implementation
- ✓ Identify strategies for overcoming common barriers
- ✓ Develop and test implementation toolkits and resources
- ✓ Evaluate national scaleup programs

➢ *For Development Partners and International Organizations*

- *WHO, UNFPA, UNICEF:*

- ✓ Continue advocating for NASG inclusion in emergency obstetric care packages
- ✓ Provide technical assistance for national NASG scaleup
- ✓ Support development of training materials and guidelines
- ✓ Fund operations research on NASG implementation

- *Bilateral Donors (USAID, DFID, etc.):*

- ✓ Include NASG procurement in maternal health project budgets
- ✓ Support health system strengthening for sustainable NASG programs
- ✓ Fund innovative approaches to NASG distribution and maintenance
- ✓ Support SouthSouth learning exchanges

- *NGOs and Civil Society:*

- ✓ Advocate for increased government investment in maternal health
- ✓ Conduct community education on PPH risks and NASG benefits
- ✓ Support grassroots monitoring of NASG availability
- ✓ Provide technical assistance to healthcare facilities

➢ *For Future Research*

- *Prospective Cohort Studies:*

Longitudinal research tracking maternal outcomes before and after NASG introduction, controlling for confounders

- *Qualitative Research:*

Indepth interviews and focus groups exploring:

- ✓ Midwives' experiences using NASG
- ✓ Institutional culture and norms affecting adoption
- ✓ Patient and family perspectives on NASG
- ✓ Decisionmaking processes around NASG application

- MixedMethods Implementation Research:
  Combining quantitative outcome data with qualitative process evaluation to understand how and why NASG programs succeed or fail

- Economic Evaluation:
  Costeffectiveness and costbenefit analyses comparing NASG to alternative PPH interventions from health system and societal perspectives

- *MultiSite Trials:*
  Cluster randomized controlled trials evaluating different NASG implementation strategies across diverse settings

- *Technology Innovation:*
  Research on NASG design modifications for Nigerian context (e.g., size variations, materials suited to tropical climate, reduced costs)

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