



Placing Oxytocin in the Immunization Cold Chain

A New, Effective Way to Help Reduce Maternal Mortality from Postpartum Hemorrhage

Summary

- Postpartum hemorrhage is the leading cause of maternal mortality worldwide.
- Although oxytocin can effectively prevent and treat postpartum hemorrhage and is the drug of choice, many women in low-resource settings lack access to high-quality oxytocin when they need it.
- A key factor that reduces access to high-quality oxytocin is loss of drug potency with prolonged exposure to heat. Although the World Health Organization (WHO) has recommended that oxytocin be kept refrigerated “as much as possible” during storage and distribution, health workers in many countries have lacked a reliable method to keep the medicine within recommended temperature ranges, especially in tropical climates.
- Because the Expanded Program on Immunization (EPI) has the world’s most effective and extensive cold chain, the United Nations Commission on Life-Saving Commodities for Women and Children has called for placing oxytocin in the EPI supply chain.
- Concerns regarding safe handling and administration of oxytocin when integrated into the EPI cold chain can be addressed with measures such as policies, guidelines, staff training and supervision, use of standard operating procedures, and product and refrigerator redesign to minimize the risk of negative consequences.
- There are no rules or regulations from WHO or the United Nations Children’s Fund (UNICEF) that preclude putting oxytocin in a national immunization cold chain although many EPI cold chain managers perceive that this is prohibited.
- To facilitate integration of oxytocin into the EPI cold chain, particularly during transportation and at the operational level where services are generally integrated, WHO, UNICEF, and other key stakeholders need to clearly communicate that this is not only permissible but also vital to saving the lives of women with postpartum hemorrhage.

THE PERSISTENT CHALLENGE OF MATERNAL MORTALITY

Worldwide, an estimated 287,000 women die each year from complications during pregnancy and childbirth. Although the global maternal mortality ratio fell by 47% from 1990 to 2010 (from 400 to 210 deaths per 100,000 live births),¹ the decline has been insufficient to meet targets under Millennium Development Goal 5 (MDG 5), which aims to reduce maternal mortality by 75% between 1990 and 2015.

Further reductions in maternal mortality hinge on ensuring that essential lifesaving commodities are available where and when they are most needed. Commodities to prevent and treat postpartum hemorrhage (PPH) are especially important because PPH is the leading cause of maternal mortality, leading to one in four deaths.² Oxytocin is a widely recommended uterotonic medicine that is effective for preventing and treating PPH.³

Creating and sustaining integrated systems to improve delivery of maternal health commodities such as oxytocin to the point of use has the potential to reduce deaths considerably. The United Nations Commission on Life-Saving Commodities for Women and Children has estimated that making uterotonic medicines, including oxytocin, available to all women giving birth could prevent 41 million cases of PPH and 1.4 million deaths over ten years.⁴

Factors that reduce the availability of high-quality oxytocin for women at delivery include cultural and socioeconomic factors, poor procurement practices, and weaknesses in distribution systems. One of the most important issues affecting access to high-quality oxytocin is the need to keep the drug in controlled temperatures to maintain potency during storage and transportation.

PURPOSE OF THIS PAPER

This paper reviews evidence and recommendations regarding storage of oxytocin under controlled-temperature conditions and discusses the importance of using the well-established immunization cold chain. It also looks at opportunities that may be explored to test the feasibility and expected benefits of integrating oxytocin into cold chains that are used in each country to store and transport vaccines for the Expanded Program on Immunization (EPI). Currently, apart from isolated instances in which individual ministries of health have required oxytocin to be stored in the cold chain (South Sudan, Senegal), oxytocin at the point of use is still largely delivered outside of this temperature-controlled system.

Many health care providers in low-resource settings are unaware of storage requirements for oxytocin, including the importance of keeping this drug in the cold chain to maintain potency. In addition, there is a common misconception among health workers that international standards prohibit other health commodities, including oxytocin, from being kept in the vaccine cold chain. Moreover, some EPI managers have expressed concerns about safety and the potential impact on the cold chain's capacity to support immunization efforts if other commodities can be stored in the cold chain. This paper draws from the work of the World Health Organization (WHO) and partners to recommend approaches that address these concerns to some extent.

Oxytocin is the drug of choice for prevention and treatment of PPH. WHO used the Recommendations Assessment, Development, and Evaluation (GRADE) methodology⁵ to provide guidance on the choice and use of uterotonic. This guidance recommends oxytocin as the uterotonic of choice because of its relative stability under temperatures up to 30°C, competitive cost, fewer side effects, and comparative efficacy.

Ensuring the quality of oxytocin at the point of use remains a major challenge, however. The quality of finished pharmaceutical products containing oxytocin is determined by three primary factors:

- The manufacturing process of the finished product: whether the process adhered to good manufacturing practices, was supported by an adequate drug master file, and met aseptic requirements.
- Storage conditions: whether the product was stored under optimal conditions at every point in the supply chain.
- Transportation conditions: whether the finished product was transported following stipulated standards.

STABILITY OF OXYTOCIN AT VARIOUS TEMPERATURES

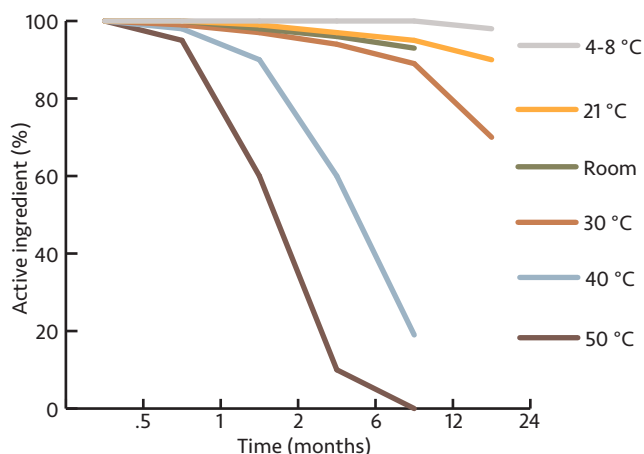
To preserve its potency, oxytocin must be stored and transported under temperature conditions needed to retain at least 90% of its stipulated active pharmaceutical ingredient (API). To support recommendations concerning the storage and use of oxytocin, WHO used a wide range of evidence.³ This included field surveys and simulation studies⁶ conducted by the Action Program on Essential Drugs to determine stability under tropical conditions. These studies showed that only 31% of a sample of oxytocic drugs kept under ambient temperatures in six tropical countries maintained the United States Pharmacopeia (USP) acceptable level of 90% to 110% of API, and another 31% had less than 60% of API. The simulation studies confirmed the results of earlier studies,⁷ which found a loss of 9% to 19% of API during storage at 30°C but no loss in potency after one year of refrigeration.

In analyzing the results of nine studies, including eight coordinated by WHO, Hogerzeil and Walker⁸ found that oxytocin has limited heat stability, especially at high temperatures. Based on evidence provided by Hogerzeil and colleagues⁷ from field and simulation studies, WHO—in section 6 of its recommendations for the prevention and treatment of postpartum hemorrhage—stated that “in settings where oxytocin is used, attention should be paid to the oxytocin cold chain (i.e. the requirements of a temperature-controlled supply chain).”³ Hogerzeil and Walker further recommended that oxytocin be kept for a maximum of one month at 30°C or two weeks at 40°C. Meanwhile, the International Dispensary Association Foundation,⁹ based on the graph showing the impact of temperature on potency, proposed a set of shelf lives corresponding to various storage temperatures (see figure on page 4).



PATH/Wancy Seamans

Oxytocin stability



Source: Simulation study of the stability of oxytocics, Michiel de Goeje.

Proposed temperature-dependent shelf life for oxytocin

Temperature	Proposed shelf life
2–8 °C	3 years
<21 °C	2 years
at 25 °C	1 year
at 30 °C	6 months
at 40 °C	1 week maximum

Storage at recommended temperatures in warehouses, during distribution, and at service delivery points remains a major challenge, particularly in tropical developing countries where refrigeration cannot be guaranteed because of the scarcity of resources and the unreliability of the electricity supply. In addition, because oxytocin may spend several months in transit from the manufacturer to the final user (a substantial portion of which may be without refrigeration), there is a significant possibility that the medicine will have an API less than 90% when administered.

In recent studies to assess the potency of oxytocin under field conditions, PATH and the USP evaluated samples taken from oxytocin stocks at the point of use in Ghana, India, and Indonesia. In Indonesia, 13 of 110 samples (12%) failed content assay. Three had an API value higher than recommended, eight contained less than 90% API, and two had undetectable levels of API. In India, 69 of 192 samples (36%) failed content assay. Twelve had an API value higher than recommended, and 57 contained less than 90% API. In Ghana, 94 of 169 samples tested (56%) failed content assay.¹⁰ Two samples had undetectable levels of API and were determined to

be counterfeit. Almost none of the samples were stored in the recommended temperature range of 2 °C to 8 °C.

INTEGRATING OTHER HEALTH COMMODITIES INTO THE IMMUNIZATION COLD CHAIN

To maintain oxytocin potency, health systems need to develop ways to ensure that oxytocin is refrigerated through the procurement and internal logistics systems and, most importantly, that it remains refrigerated at the point of use. Immunization programs offer one of the most promising opportunities to ensure refrigeration.¹¹ In many countries, the Expanded Program on Immunization has developed functional systems upon which effective interventions can be modeled to ensure access to quality-assured essential health commodities at the point of use. Commodities such as oxytocin that require special handling because of their temperature sensitivity stand to benefit from this integration with immunization systems.

Several global declarations support the integration of services. In his forward to the 2010 *Global Strategy for Women's and Children's Health*,¹² the United Nations Secretary General, Ban-Ki-Moon, stated that the strategy “sets out the key areas where action is urgently required to enhance financing, strengthen policy, and improve service delivery” and that one of these areas is “integrated delivery of health services and life-saving interventions—so women and their children can access prevention, treatment, and care when and where they need it.”

Similarly, the Global Vaccine Action Plan 2011–2020¹³ has included full integration of national immunization plans into national health plans, especially at primary health care levels, as one of its principal aims. This is in line with the spirit of the 1984 WHO cold chain design named “Logistics and Cold Chain for Primary Health care.”¹⁴

Integration not only pools resources for greater efficiency but also has the potential for greater social mobilization for all programs concerned. The 2005 Paris Declaration on Aid Effectiveness¹⁵ stated the need for donors to align strategies to host country objectives and to use existing systems to “eliminate duplication of efforts and rationalize donor activities to make them as cost-effective as possible.”

EXAMPLES OF SUCCESSFUL INTEGRATION OF HEALTH COMMODITIES WITH IMMUNIZATION SERVICE DELIVERY

WHO and UNICEF have been at the forefront of efforts to integrate other health commodities into immunization systems. For example, these organizations have advanced

ABOUT THE UN COMMISSION ON LIFE-SAVING COMMODITIES FOR WOMEN AND CHILDREN

The United Nations *Global Strategy for Women's and Children's Health* highlights the inequities suffered by women and children around the world and sets an agenda to save 16 million lives by 2015. The UN Commission on Life-Saving Commodities for Women and Children is helping to implement this strategy. Cochaired by President Goodluck Jonathan of Nigeria and Prime Minister Jens Stoltenberg of Norway, the commission has approximately 20 members drawn from public, private, and research/academic organizations around the world. In September 2012, the Commission launched a report outlining ten key recommendations for improving access to 13 lifesaving, cost-effective commodities for reproductive, maternal, newborn, and child health. Oxytocin is one of the 13 commodities. Under Recommendation 6, which states that the "supply of the 13 commodities must be improved at the country level," the commission has set out to ensure that oxytocin is integrated into the global vaccine cold chain.

efforts to integrate vitamin A supplementation into routine immunization programs in several countries. Although vitamin A supplementation is provided in biannual campaigns and not integrated in daily immunization activities or in the cold chain, this effort has demonstrated the synergies that can be created by integrating different products at the point of use.

To study the policy and program implications of this integration, WHO's Global Program for Vaccines and Immunization convened a meeting of international agencies involved in immunization and micronutrients, a meeting that was hosted by UNICEF in New York.¹⁶ Forum participants noted that vitamin A supplements provided by health, nutrition, or immunization workers are the most important means of getting vitamin A to mothers immediately after delivery. Immunization services often provide the only routine contacts with health services for mothers and their infants, and integrated efforts using the same channels to transport vaccines and vitamin A to remote areas can increase vitamin A uptake without decreasing immunization coverage. (It should be noted, however, that health workers may need to use different mechanisms, including coolers, to transport vaccines and oxytocin.)

Another example of integration is the distribution of insecticide-treated bednets (ITNs) in collaboration with immunization programs. In 2004, Togo was the first country to experiment with integrating distribution of ITNs (to prevent malaria) into a nationwide immunization campaign.¹⁷ This integrated approach,

together with other interventions, increased the proportion of households owning ITNs from 8% to 62%. Similarly, a pilot project in Ghana, conducted in collaboration with the Red Cross and UNICEF, found that integrating distribution of ITNs into a measles campaign led to high and equitable coverage.¹⁸

The fact that oxytocin is listed in the WHO model list of essential medicines and is included in the lists of essential medicines and standard treatment guidelines in most countries will facilitate its integrated procurement and delivery alongside vaccines. In addition, creating a "one-stop shop" for health services through immunization programs may help to stimulate women's health-seeking behaviors and thereby reduce health inequities.

Lessons learned from integration of other commodities into intermittent immunization campaigns can help to identify potential challenges that need to be addressed before introducing oxytocin into the routine immunization cold chain.

POTENTIAL CHALLENGES, SOLUTIONS, AND BENEFITS ASSOCIATED WITH INCLUDING OXYTOCIN IN THE IMMUNIZATION COLD CHAIN

Most disease control programs in low- and middle-income countries, including immunization programs, that have historically managed independent supply chain systems are under increasing pressure to store and transport larger volumes of higher-value products from the national level to the service-delivery level. It has been widely recognized that immunization supply chains in particular will require significant investments before they will be ready to handle an increased volume of new, bulkier, and more expensive vaccines, let alone other health commodities. The capacity of national EPI cold chains may thus already be stretched, and the introduction of new products will require new strategies and additional cold storage capacity. Without addressing these challenges, vaccine supply chain systems are likely to be a bottleneck for new vaccine introduction or integration of other commodities.

To address this challenge, a draft modeling framework for calculation of country oxytocin needs developed by the UN Commission's Recommendation 6 Working Group with input from the maternal technical reference teams can be used to estimate the additional volumes needed at central-level cold chain stores for integration of oxytocin. Rough calculations using this model suggest that the required volumes may not be exceedingly high, especially if the country opts for split procurement/delivery (see Annex 1). However, given that different factors come into play during transportation

and storage at the intermediate and peripheral levels, operational research is needed to capture the information that will be needed for further modeling.

Safety concerns have been raised by some immunization stakeholders, including bloggers in a recent discussion on the TechNet blog (TechNet-21).¹⁹ For example, some immunization professionals expressed concerns about possible identification errors as a result of integrating oxytocin into the immunization cold chain, which may lead health workers to use oxytocin instead of diluent for BCG vaccine reconstitution. In a search of published evidence on accidental use of oxytocin, however, we found only one reported incident²⁰ of a premature infant who accidentally received oxytocin instead of vitamin K intramuscularly shortly after birth. The patient remained hemodynamically stable but developed transient hyponatremia as the sole biochemical abnormality.

The TechNet bloggers generally agreed on the need to store lifesaving drugs such as oxytocin in the cold chain. One TechNet participant summarized the issue well:

If there is now to be a policy that drugs may be stored in a vaccine refrigerator, then there need to be some policies and operating procedures established to ensure that those drugs can be safely stored. It may also require some specific redesign of refrigerators to have separate compartments for non-vaccines. It will certainly require substantial training before the change is made.

At a 2009 Cold Chain and Logistics Taskforce Workshop²¹ hosted by UNICEF in New York, participants identified the lack of guidance (standard operating procedures) on how EPI systems can address integration without compromising performance as a key hurdle to full integration with other public health programs. One of the issues that will need to be considered by Intra-country Coordination Committees and National Immunization Technical Advisory Groups is the impact of integrating oxytocin on the quality of the cold chain as a whole. In addition, EPI experts and country EPI managers want to know how introducing oxytocin into the EPI cold chain will benefit the EPI program.

In recent publications highlighting the need to overcome the challenges that generate these concerns, Stanton and colleagues²² and Souza²³ present evidence suggesting that appropriate technology, training, standard operating procedures, and supervision may enable oxytocin use to be safely extended to community health workers serving women giving birth in communities and under-resourced settings—including, in some contexts, home births—to further reduce maternal deaths. Immunization program channels and mechanisms are the most

UN COMMISSION'S APPROACH TO INTEGRATING OXYTOCIN IN THE COLD CHAIN

The UN Commission on Life-Saving Commodities for Women and Children is implementing two parallel approaches to drive integration of oxytocin in the cold chain, and especially the immunization cold chain:

- **High-level advocacy.** The goal of this activity will be to get a joint statement signed by WHO and UNICEF to dispel the misconception that nothing but vaccine should go in the cold chain and to recommend that countries conduct operations research to generate evidence on the feasibility and challenges of this integration.
- **Country-level advocacy and targeted pilot operations research projects.** A few Pathfinder Countries* will be selected for operations research projects at a small-scale, regional level, or a national level, depending on available resources. Information from these projects will be provided to decision-makers at higher levels.

* In 2013, eight Pathfinder Countries were initially selected for funding of country action plans: Democratic Republic of the Congo, Ethiopia, Malawi, Nigeria, Senegal, Sierra Leone, Uganda, and the United Republic of Tanzania.

established systems that can be used to help ensure that women in even the most remote areas have sustainable access to oxytocin that meets quality standards.

Project Optimize, a collaboration between PATH and WHO, has published a document²⁴ that examines the rationale, benefits, and challenges associated with integration of vaccine supply chains with supply chains for other health commodities. The document provides agencies, donors, decision-makers, and partners with an overview of supply chain integration and lessons learned during Optimize demonstration activities in Senegal and Tunisia.

Project Optimize collaborated with national immunization programs in Senegal and Tunisia to demonstrate how integrated, streamlined health supply systems might work. In Senegal, the objective was to create a single integrated health supply chain with a modern management information system for all public-sector vaccines, drugs, and other health products. In this demonstration, a moving warehouse equipped with an information management system drove to health facilities to resupply warehouses and provide supportive supervision. In Tunisia, a pilot project tested integration

in two regions, with the ultimate aim of creating a single, streamlined, and integrated health supply chain.

Based on lessons learned during Optimize,²⁴ key challenges to integrating vaccines with other health care commodities may include:

- **Resistance among stakeholders leading to delays.** Integration calls for changes to practices and roles that have been in place for many years, and some stakeholders will resist these changes. This resistance will need to be addressed through advocacy and communication to alleviate apprehensions and concerns as well as mobilization of resources to implement integration. Overcoming resistance will require meetings and negotiation to agree on principles and rules of engagement.
- **Human resource capacity.** Program staff members are already extremely busy and will need to take on new responsibilities to implement integration. They will need additional training and coaching. Integration will not only require strengthening the capacity of existing staff but also recruiting new staff. All of this will require planning, resources, and sufficient time for training and follow-up.
- **Flow of funds.** A major challenge is ensuring that existing programs are paid for their services. Portions of the funds for different health programs will need to be combined to operate a single, integrated supply system for these health products. Programs have different and sometimes complex funding sources and channels and may face difficulties or be reluctant to transfer funds for services that are valuable but difficult to quantify. They may feel that transferring funds also means transferring responsibility and control.



PATH/Shirley Villalago

When implementing a supply chain integration strategy, it will be important to convince all stakeholders that the new integrated system will improve the overall supply chain, increase efficiency, and lower overall costs. Supply chain integration is a major structural undertaking that can be very difficult but also very effective in the long term. By moving from vertically managed programs toward horizontally integrated systems, public health programs may improve both efficiency and effectiveness as long as the right steps are taken. Potential benefits include:

- Increased economies of scale using infrastructure, equipment, and human resources at full capacity and selling or relocating unneeded warehousing facilities, vehicles, and refrigerators to elsewhere in the health system.
- Increased flexibility and adaptability to enable expansion of products and growth of the network through a clear, segmented framework of operations.
- Improved efficiency through better use of existing resources, streamlined delivery routes, and specialization of supply chain professionals.
- Improved performance of supply chains and disease control programs.

In the case of oxytocin integration, pooling of resources from otherwise disparate health programs struggling to meet women's health needs will boost immunization supply chains in settings where resources are scarce.

NEW IMPETUS FOR GREATER SUPPLY CHAIN INTEGRATION

As immunization supply chains struggle to meet current and upcoming challenges, the lines are being blurred between vaccine supply chains and those for other health commodities. Historically, vaccines were the only set of health products requiring a national cold chain, and a vertical supply chain was justified. Today, there is a push for increased access to the well-established immunization cold chain not only for oxytocin but also for a growing number of other pharmaceutical products, such as insulin, some antiretroviral drugs, and antibiotics that require controlled-temperature storage. This has led to new opportunities for supply chain integration between vaccines and other public health commodities.

In describing integration of services as an important step toward achieving MDGs, the GAVI Alliance has stated that “the high coverage of routine immunization services provides an important entry point for women to access an integrated package of maternal and child health services.”²⁵ Moreover, in the 2013 new and underused

vaccines support application guidelines,²⁶ GAVI states that “The ICC or equivalent national coordinating body, including any technical EPI advisory groups, should be closely involved in the process of deciding whether to introduce a new vaccine to ensure that all information and options have been taken into account, and to guide effective integration of immunization initiatives.” These statements clearly show GAVI’s desire to ensure that any new additions to current immunization systems are carefully assessed. Such an evaluation process provides an opportunity for the National Immunization Technical Advisory Group to expand analysis to include other health commodities.

One of the approaches to improve access to high-quality oxytocin at the point of use that is under consideration is the use of a controlled temperature chain (CTC), which is used to extend the reach of the immunization cold chain. In a recently published guideline for immunization program decision-makers and managers, specific to the use of MenAfriVac™ (meningitis A vaccine), WHO recommended the use of a CTC during campaigns.²⁷ These recommendations can be adapted for the use of the CTC for storage and transport of oxytocin to the most peripheral places of birth. This could facilitate the use of high-quality oxytocin during home deliveries assisted by skilled birth assistants or auxiliary health workers.²⁸

CONCLUSION

WHO and UNICEF are taking the lead in efforts to introduce other health commodities into EPI systems. At the same time, GAVI, in light of other funding mechanisms, has expressed an interest in carefully negotiated introductions, and there is an emerging international consensus among stakeholders that an integrated approach to health will advance efforts to achieve the Millennium Development Goals.

Current conditions offer a critical window of opportunity for integrating oxytocin into EPI vaccine delivery cold chains to increase the likelihood that women in low-resource settings can receive high-



PATH/Robin Biellik

quality oxytocin in a timely manner when it may be needed to save their lives. To explore opportunities for integrating oxytocin into the EPI cold chain, WHO and UNICEF encourage an evidence-based decision-making process that reviews the available evidence and issues concerning the safety of including oxytocin in the immunization cold chain and then provides this information to the Strategic Advisory Group of Experts (SAGE) at WHO for consideration. This will entail concentrated efforts by countries to avail or generate the necessary evidence. National and subnational operational research is needed to generate evidence on the feasibility and challenges of this integration.

Annex 1. Estimated need for oxytocin in eight Pathfinder Countries (based on work by the MH-TRT Tools subgroup)

Variable	DRC	Ethiopia	Nigeria	Malawi	Senegal	Sierra Leone	Tanzania	Uganda
Total population	67,800,000	84,700,000	162,500,000	15,400,000	12,800,000	5,900,000	46,200,000	34,900,000
Crude birth rate	0.043	0.031	0.04	0.044	0.037	0.038	0.041	0.045
Estimated yearly births	2,915,400	2,625,700	6,500,000	677,600	473,600	224,200	1,894,200	1,570,500
Percent hospital deliveries/SBA	80	10	50	71	65	63	50	60
Estimated SBA/hospital deliveries	2,332,320	262,570	3,250,000	481,096	307,840	141,246	947,100	942,300
Prevention - AMTSL (10 IU)								
Target coverage AMTSL	70%	50%	50%	90%	80%	80%	90%	80%
Oxytocin needed for AMTSL (10 IU ampoule)	1,632,624	131,285	1,625,000	432,986	246,272	112,997	852,390	753,840
Treatment (4 x 10 IU)								
PPH after AMTSL	3%	3%	3%	3%	3%	3%	3%	3%
Women with PPH after AMTSL	48,979	3,939	48,750	12,990	7,388	3,390	25,572	22,615
Oxytocin need for PPH treatment (4 x 10 IU)	4	4	4	4	4	4	4	4
Oxytocin needed for treatment after AMTSL	195,915	15,754	195,000	51,958	29,553	13,560	102,287	90,461
PPH if no AMTSL	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
Oxytocin need for PPH treatment (4 x 10 IU)	4	4	4	4	4	4	4	4
Oxytocin needed for treatment (No AMTSL)	395,095	548,771	1,072,500	96,867	80,019	39,144	412,557	287,464

Variable	DRC	Ethiopia	Nigeria	Malawi	Senegal	Sierra Leone	Tanzania	Uganda
Augmentation (3 x 10 IU)								
Augmentation/ induction (3 x 10 IU)	15%	15%	15%	15%	15%	15%	15%	15%
Ampoules needed for augmentation	349,848	39,386	487,500	72,164	46,176	21,187	142,065	141,345
Total need (ampoules)	2,573,482	735,196	3,380,000	653,976	402,020	186,887	1,509,299	1,273,110
Volume per ampoule shipped (cu cm)	20	20	20	20	20	20	20	20
Total volume (liters)	51,470	14,704	67,600	13,080	8,040	3,738	30,186	25,462
Volume (cubic meters)	51.47	14.70	67.60	13.08	8.04	3.74	30.19	25.46
1 shipment	51.47	14.70	67.60	13.08	8.04	3.74	30.19	25.46
2 shipments	25.73	7.35	33.80	6.54	4.02	1.87	15.09	12.73
3 shipments	17.16	4.90	22.53	4.36	2.68	1.25	10.06	8.49
Unit cost of oxytocin (US\$)	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Cost of oxytocin (US\$)	514,696	147,039	676,000	130,795	80,404	37,377	301,860	254,622

Abbreviations: AMTSL = active management of the third stage of labor, DRC = Democratic Republic of Congo, PPH = postpartum hemorrhage, SBA = skilled birth attendance

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