Ethiopia

Commitment to saving innocent lives

Best practice in Neonatal Intensive Care Units

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Addis Ababa

VSO

Irish Aid

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Acknowledgements

VSO Ethiopia has been implementing a project intended to save the lives of neonates who come to hospital with various problems. The objectives of the project are believed to be achieved through the promotion and establishment of neonatal intensive care units (NICUs) in the hospitals. NICUs have been established in three hospitals in the Southern Nations Nationalities and Peoples Region (SNNPR).

First and foremost, VSO Ethiopia would like to express its gratitude to UNICEF and Irish Aid, who were generous enough to fund the project's activities. VSO Ethiopia also forwards its thanks and appreciation to those dedicated and passionate VSO volunteer medical doctors and paediatricians, Dr Elizabeth Ledger and Dr Toby Candler, who established NICU in Yirgalem and Nigist Eleni Memorial Hospital, and Dr Jo Cryer and Dr Andrew Cornish, who established NICU in Arba Minch hospital. VSO Ethiopia has no words to thank them enough for their tireless efforts to realise VSO Ethiopia's maternal, newborn and child health (MNCH) programme in these three hospitals.

VSO Ethiopia also extends its gratitude to the Ethiopian Pediatrics Society (EPS), Dr Mulualem Gessesse and Professor Bogale Worku, the Regional Health Bureau (RHB) of SNNPR, the Zonal Health Departments of Sidama, Hadiya and Gamogoffa zones, and the management and medical personnel of the three project hospitals, particularly the NICU nurses who made it all happen.

VSO Ethiopia hopes that this "good practice" document will be of great use to these organisations, allowing them to better inform their decisions by incorporating it into their policies, programmes, procedures, monitoring and evaluation mechanisms while establishing and strengthening NICU services.

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Based on the success of the NICU project implemented in Yirgalem, Hossana and Arbaminch hospitals, VSO Ethiopia has obtained additional funding from Irish Aid to establish NICUs in three hospitals in Tigray region, northern Ethiopia. VSO Ethiopia also received funding from VODACOM to establish NICU at Sodo Hopsital in Wolayta-Sodo town in SNNPR Region and Melka-Oda Hospital in Shashemene town in Oromia region.

Contents

Acronyms

ANC	Antenatal Care
CPAP	Continuous Positive Airway Pressure
CPR	Cardiopulmonary Resuscitation
EBM	Expressed Breast Milk
EDHS	Ethiopian Demographic and Health Survey
EPS	Ethiopian Pediatrics Society
FMoH	Federal Ministry of Health
GP	General Practitioner
HEW	Health Extension Worker
HMIS	Health Management Information System
HO	Health Officer
HSDP	Health Sector Development Plan
KMC	Kangaroo Mother Care
LBW	Low Birth Weight
MDG	Millennium Development Goal(s)
MNCH	Maternal, Newborn and Child Health
MoH	Ministry of Health
NEMH	Nigist Elleni Memorial Hospital (Hossana)
NG	Nasogastric
NGO	Non-Governmental Organisation
NICU	Neonatal Intensive Care Unit
OPD	Outpatient Department
PAP	Programme Area Plan
PFSA	Pharmaceutical Fund and Supplies Agency
PICT	Providers Initiated HIV Counseling and Testing
RHB	Regional Health Bureau
SNNPR	Southern Nations Nationalities and Peoples Region
SOP	Standard Operating Procedure
ToT	Training of Trainers
TVET	Technical and Vocational Education and Training
VSO	Voluntary Service Overseas
WHO	World Health Organisation

Executive summary

VSO Ethiopia has supported the establishment and development of neonatal intensive care units (NICUs) in three hospitals in SNNPR, namely Nigist Elleni (Hosanna), Arba Minch and Yirgalem. VSO commissioned a consultancy team to identify and document the best practices of the NICU services and the lessons that could be drawn from these. The team collected all the necessary data related to the NICUs, from the pre-establishment situation to the establishment process and post-establishment services and achievements, through key informant interviews, documents reviews and on-site observations. The rationale for the documentation of best practices is to acquire adequate information to help VSO improve the future design and implementation of its programmes. To that end, it is expected that VSO will incorporate the lessons drawn from the experience into its policies, programmes, procedures, and monitoring and evaluation systems. The best practices are also believed to provide a model for other organisations that intend to establish and run NICUs.

The process

The NICU establishment process was anything but easy. It all started in Yirgalem following the assignment of two VSO volunteers, Dr Toby and Dr Liz (both paediatricians), to the paediatric department of Yirgalem hospital. Most medical staff (often including managers and medical directors, and in one case, a paediatrician) regarded neonates as children who could be treated within the existing paediatric wards alongside older children, and could not see the necessity of establishing NICUs. Thus, making the case for NICUs required a lot of lobbying, perseverance and commitment. The achievements of the Yirgalem NICU sparked the desire to establish another NICU in Hossana with technical support from the volunteers. A few months later, two more VSO volunteers were assigned to Arba Minch hospital, where they established the third NICU.

The first requirement for establishing a NICU was to convince the hospital authorities, and often the zonal health department officials, of the importance of the unit for saving the lives of neonates, of its tremendous contribution to the Millennium Development Goals (MDG) and of its being in harmony with the national health sector development programme, etc. It also required finding a place within the hospital structure that could be converted into a NICU. The next step was to purchase the necessary equipment and materials, some of which could be locally produced in Hawassa Technical and Vocational Education and Training (TVET) college. The latter contributed a lot to the cost-effectiveness of the project.

The achievements

On the whole, the best practices identified by the assessment included:

Capacity building

The project built the capacity of the target hospitals by providing training on the management of neonatal care and neonatal resuscitation for all nurses, general practitioners (GPs) and other professionals with an interest, as well as a six-week standard training course for NICU nurses. The practical skill of the NICU nurses was enhanced by preparing (adapting) normative and Standard Operating Procedure (SOP) – guidelines, protocols, manuals, algorithms, flowsheets, admission criteria, etc – and making them available for reference. An expedient, mutually supportive and collaborative working environment was created among the various units of the hospital that have contact with newborns, such as the outpatient department (OPD), obstetrics, paediatrics and the NICUs. This helped newborns to quickly and smoothly reach NICU for lifesaving management, sharing of available resources such as drugs and other supplies, etc.

Mentorship and transfer of knowledge

Besides formal classroom training, the VSO volunteers implemented the transfer of knowledge in the form of mentorship and teaching by doing. This included simulation scenarios and problem-based learning while introducing and encouraging an evidence-based approach to medicine.

Cultivating commitment, conscientiousness and perseverance among local staff

The initial stage of the establishment of the NICUs was full of challenges that would have aborted the entire project had it not been for the determination and perseverance of the volunteers as well as the potential NICU nurses and some health professionals outside the unit. The NICU nurses learnt a lot from the commitment, conscientiousness and enthusiasm of the VSO volunteers.

Innovation

The project used locally available materials to produce essential equipment, such as resuscitator, incubator, phototherapy, and heaters that are cost-effective, simple to use and not reliant on complex maintenance. It established supplies and medication compartments for emergency care: an emergency box and NICU mini-store.

Valuing research

The VSO Ethiopia volunteers started their work by conducting rapid situational assessment in these hospitals to determine the most appropriate kind of intervention and how it should be pursued. The results of the assessment are also intended to serve as a benchmark against which post-intervention achievements will be gauged.

Documentation

The volunteers introduced a mechanism for documenting routine statistics including admission and outcomes such as discharge and death, which were seldom captured by the health management information system (HMIS) section. Protocols and flowcharts which are critical for routine clinical management, such as life-event monitoring charts and management protocols (eg monitoring of glucose level, drug chart, etc) were posted in places where they were easily seen.

In sum, the VSO-E-supported NICU was found to meet all the criteria against which best practices are judged: relevance, effectiveness, efficiency, innovation, impact and sustainability.

Based on the results of the assessment, the assessment team recommended that the already established NICUs be further strengthened, with the hospital administration playing a leading role in this regard, and that health departments in neighbouring zones be consulted in order to establish more NICUs, which will increase access to newborn care services while reducing the workload of the already established NICUs. It also pointed out the need for community mobilisation using health extension workers (HEWs) and community conversation sessions to combat traditional attitudes, misconceptions and practices related to neonates and to create demand for institutional care.

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Introduction and background

Introduction

VSO is a leading independent non- governmental organisation (NGO) that works through volunteers to fight poverty. VSO was founded in 1958, and since then over 50,000 volunteers have worked in over 140 developing countries in Africa, Asia, the Pacific, the Caribbean, eastern Europe and Latin America. VSO programme areas include Education, Health, and securing livelihoods. VSO's mission is to bring people together to fight poverty through sharing knowledge and skills, aiming to enrich and complement government programmes by learning lessons from past experiences and building on existing initiatives. VSO started operating in Ethiopia in 1998, having been invited by the Ethiopian government to support the education sector. Since then, it has expanded the scale and scope of its country programme. The health programme supports the implementation of the national Health Sector Development Plan (HSDP), and contributes to the improvement of the population's health through quality preventive, basic curative and rehabilitative health services. In late 2009, a new five-year Country Strategic Plan was developed. Currently the VSO health programme is implemented in the Benshangul-Gumuz, Amhara, SNNPR, Addis Ababa, Tigray, Afar and Oromia regions. Currently VSO Ethiopia is one of the largest country programmes, with approximately 100 volunteers working in the areas of education, health and securing livelihoods at any one time.

In 2009, VSO Ethiopia expanded its HIV programme into a health programme with a focus on maternal, newborn and child health (MNCH). With support from Irish Aid Ethiopia, VSO has been addressing this need by working with health-training institutions and hospitals and strengthening evidence-based planning in the RHB of SNNPR and Tigray. The programmatic interventions of VSO focus at multiple levels, targeting RHBs, hospital management, senior clinical staff, and administrative staff.

Background: statement of the problem

Neonatal mortality, accounting for an estimated 4 million deaths worldwide each year, constitutes 40% of under-5 mortality and approximately 57% of infant mortality. Most neonatal deaths (99%) arise in low- and middle-income countries, and approximately half occur at home. In the past two to three decades, neonatal mortality rates have shown a slow decline in developing countries whereas infant and under-5 mortality rates have declined significantly. Over the last decade, neonatal deaths have gained importance on the world policy agenda because the MDG for child survival cannot be met without substantial reductions in neonatal mortality. It is estimated that reduction of under-5 child mortality by two-thirds by 2015, as called for by the MDG, requires a reduction in neonatal mortality by at least 50%. There are highly feasible and cost-effective interventions that could avert up to 72% of neonatal deaths, but this can only be achieved if countries adopt locally relevant and focused interventions that are guided by evidence.

The Ethiopian scenario

With a population of more than 85 million, Ethiopia is the second most populous country in Africa after Nigeria. The population grows at a rate of about 2.6% per annum and the majority of people (82%) reside in rural areas, with agriculture being the major source of livelihood.
High mortality, high fertility and low life expectancy characterise the demography, as in most sub-Saharan African countries. In the past decade, however, the country has witnessed an unprecedented decline in under-5 mortality from 166 per 1,000 live births in 2000 to 88 per 1,000 live births in 2011, a decline of 47%.

Approximately 42% of the under-5 mortality in Ethiopia is attributable to neonatal deaths. According to the 2011 Ethiopia Demographic and Health Survey (EDHS), the country is experiencing a high neonatal mortality rate of 37 per 1,000 live births, comparable to the average rate of 35.9 per 1,000 live births for the African region overall.

Reducing newborn morbidity and mortality is a major government priority in Ethiopia, in line with the MDG and as indicated in the HSDP. While an impressive reduction has been made in child mortality, neonatal mortality is currently on a plateau across Ethiopia. Ways to reduce this include

the establishment of NICUs, alongside improving community level newborn care programmes. A NICU is a special care unit where newborn babies who need intensive medical attention are admitted and cared for by a combination of more advanced technology and trained healthcare professionals.

Lack of adequate documentation has been a major problem for healthcare providers seeking to understand the scale of, and the socio-medical etiological factors that contribute to, neonatal deaths (Mela, 2013)[1].

VSO Ethiopia intervention

VSO Ethiopia has focused on the national and regional level prioritised MNCH agenda with the purpose of enhancing the skill of health workers and strengthening the health systems. Its intervention is based on a five-year Programme Area Plan (PAP) that intends to "contribute its share to the realisation of HSDP of Ethiopia". The objectives of the VSO Ethiopia MNCH programme were to:

- provide training/lectures for students in clinical area and classroom settings particularly on basic emergency obstetric and neonatal care
- assist the teaching hospitals in establishing or strengthening neonatal intensive care units at their hospitals
- assist the RHB in establishing NICUs at other key non-teaching hospitals as per request
- assist the universities in providing quality paediatric and neonatal health education to undergraduate as well as postgraduate students
- assist RHBs and universities in establishing standard paediatric and neonatal care and service delivery guidelines
- assist universities in the conduct of essential paediatric health research with focus on neonatal health
- assist in the neonatal health service provision at these hospitals as much as time permits

In line with the above general objectives, VSO Ethiopia in collaboration with its donor partners and the RHB of SNNPR has been implementing a project focused on neonatal care. The major activity has been the establishment of three NICUs at the Nigist Eleni Memorial (Hosanna), Arba Minch and Yirgalem hospitals respectively, enabled by technical

(professional) support provided by volunteers and modest financial assistance. Two volunteer paediatricians were placed in Yirgalem hospital who later also supported Nigist Eleni hospital; one paediatrician and one GP were also placed in Arba Mich hospital to support the country's MNCH initiatives.

With the aim of identifying and documenting the best practices of the NICU services and the lessons to be drawn from these, VSO deployed an independent consultancy team consisting of a public health specialist and a social scientist. The ultimate value of the documentation of best practices is in paving the way for future better performance of programmes. The practices, as intellectual assets, are designed to help VSO remain highly competitive by incorporating them into its policies, programmes, procedures, monitoring and evaluation systems. They will also provide a model for others that intend to establish and run NICUs.

[1] Apart from this, an innovative project (The SURPLAREV Process: For the BEAT.3D Project) has been implemented in Benishangul Gumuz region which positively affects the MNCH programme of the region (Mela Research Plc, 2013).

Conceptualising best practice

At its most basic, "best practice" suggests a simple maxim: "Don't reinvent the wheel but learn in order to improve it, and adapt it to your terrain to make it work better" (AIDSNet, 2005)[2]. While this metaphor is clearly too simple, it certainly captures the essentials of what good practice is all about: learning from the success of others, with the objective of improving the overall performance of one's own programme. Good practice has also been defined as "knowledge about what works in specific situations and contexts, without using inordinate resources to achieve the desired results, and which can be used to develop and implement solutions adapted to similar health problems in other situations and contexts" (WHO, 2008)[3]. It refers to the process of gathering and applying knowledge of what is working and what is not working in different situations and contexts through feedback, learning and reflection.

Whatever definition is used, however, there is an element of accumulating knowledge and building on the basis of the practice of others. In summary, the "good practice" process helps to identify and describe the lessons learned and the keys to success of any given project, programme or policy. Exactly how an organisation embarks on a process of identifying and implementing good practices differs from one to another, since determining what is a good practice in a given field or sector is one of the most challenging aspects of making the concept operational.

However, one of the key features of UNAIDS' best practice definition is that it is not reserved only for "truths" or "gold standards", but that a best practice can be anything that works, in full or in part, and can be useful in providing lessons learned. Nevertheless, a "good practice" should meet at least the "effectiveness", "efficiency" and "relevance" criteria in addition to one or more of the other criteria.

In an attempt to identify and document best practices of VSO's interventions, the NICU activities in the three hospitals were examined against the above-listed criteria as well as the objectives of the project. The assessment was done by professional consultants external to VSO Ethiopia in July 2013.

Purpose of this "good practice" document

The purpose is to "identify and document best practice" through evaluation of the NICU services supported by VSO Ethiopia and provided by the volunteer health professionals in the three hospitals, with the overall aim of identifying potential for scaling up and replicating the projects.

Methodology used

Qualitative research methodology with various data collection techniques was employed to gather available and relevant data and identify best practices. The data collection techniques included document reviews, key informant interview and on-site observation. More detailed probing has been done and case stories are included where appropriate to demonstrate good practice. (See list in Appendix I.)
Reviewed documents included: VSO's project documents, volunteers' terminal reports, policy documents, research outputs on the problems and rates of neonatal mortality, what has been attempted to tackle the problems at national and international levels, the target hospitals' routine reports, training manuals, and guidelines. E-documents and research outputs on neonatal care as well as on conceptual issues of best practice have also been consulted.

Key informant interviewees included VSO volunteers (only in Arba Minch hospital), NICU nurses, hospitals' medical directors and managers, paediatricians and GPs who have been working in the NICUs, service users (mothers of newborns whose children are receiving services or who have once received services), etc (See list in Appendix II.)

The various ways neonatal health problems are handled at the NICUs in the three target hospitals were also closely observed so as to record the best practices, the challenges being faced and the innovative mechanisms used to overcome or mitigate the challenges.

[2] Manual on Best Practices HIV/AIDS Programming with Children and Young People – Aidsnet 2005

[3] Guide for Documenting and Sharing "Best Practices" in Health Programs – WHO, 2008

Results of the assessment

The project implementation

The genesis: Yirgalem

Two VSO volunteers, Dr Toby and Dr Liz, both paediatricians, were assigned to the paediatric department of Yirgalem hospital to provide care for paediatric patients who came from all corners of the surrounding zones. These volunteers soon observed a mismatch between the enormous number of newborn infants coming to the hospital with various kinds and complexity of medical conditions and the available type and quality of service.

Severely ill newborn babies were admitted to the paediatric wards and treated by health professionals with no special training in newborn care and there was no dedicated room or corner for neonates. The number of neonatal deaths was too high, especially among preterm and very low-birth-weight (LBW) babies. The volunteers raised with the hospital management the need to establish a mechanism for providing professional newborn care to those requiring it.

Subsequently the volunteers repeatedly, formally and informally, consulted all local staff involved in the care of neonates as to their vision of a neonatal unit. They also sought advice from the Ethiopian paediatricians Dr Lamesginew Mossie and Dr Wossen Teklehaiminot as to the design and provision of required equipment for a NICU. They also communicated with Dr Mulualem, consultant neonatologist at Yekatit 12 Hospital, and Professor Bogale, executive director of the Ethiopian Paediatric Society (EPS), who had developed and were running a training programme for NICU nurses in Addis Ababa.

After extensive consultation, creating awareness of the need for specialised newborn care was identified as the appropriate starting point to reduce mortality rates. Health professionals working in three units where newborn with life-threatening medical problems might come to seek emergency help were identified, namely the gynaecology and obstetrics department, the paediatric department and the operating theatre.

First a three-day training of trainers (ToT) was provided for medical doctors by the two volunteer doctors. The second stage was to provide a two-day training to staff (more than 40) from the different categories (though predominantly nurses from the three departments) on the basics of neonatal resuscitation in four rounds. This training succeeded in creating an interest among staff in providing the newborn with the better care they deserved. Additionally, a kangaroo mother care (KMC), a simple, cheap and very effective method of keeping newborn babies warm, was introduced for the first time in the hospital.

Some two months later, the two volunteers along with the hospital management contacted Dr Mulualem and discussed how to access extended training and other essential technical support for NICU nurses. Based on interest demonstrated during the local training and commitment to care of neonates on the paediatric ward, four nurses were selected to receive the six weeks' standard Federal Ministry of Health (FMoH) training on newborn care at Addis Ababa. Upon return, the new Neonatal Intensive Care Unit (NICU) was established.

In the meantime Dr Toby and Dr Liz established a relationship and partnership with TVET to locally produce basic equipment for NICU. List and price quotations were developed for equipment that could not be produced by TVET and procured from Addis Ababa. Guidelines were also developed to be used for routine functions and on-site training of health workers.

The replication: Nigist Elleni Memorial Hospital

During the inauguration of Yirgalem NICU, Dr Mulualem discussed with Dr Toby and Dr Liz the possibility of establishing newborn care units at Nigist Elleni Memorial Hospital (NEMH), given the opportune the presence of Dr Lamesginew Mossie, a good friend and colleague, at Hossana. Dr Lamesginew, when he was in Yirgalem, was proactively involved throughout the establishment of the NICU, including in the delivery of the initial training course as well as in designing the unit.

After being transferred to NEMH, Dr Lamesgenew faced a struggle to establish a neonatal care unit and was witnessing too many newborn deaths in the hospital that could have been averted. He was aware of what had been achieved at Yirgalem through the NICU, but the traditional way of thinking of other staff and the management, who regarded newborns as children who could be treated within the existing paediatric wards alongside older children, made addressing the high neonatal mortality at NEMH very challenging.

Needing support, Dr Lamesgenew contacted the VSO Ethiopia doctors at Yirgalem hospital and invited them to visit NEMH at Hossana. After repeated meetings and discussions, the volunteers came to Hossana with two other Ethiopian medical doctors who had taken the Yirgalem three-day ToT course. This group provided a two-day training course on neonatal resuscitation to over 20 interested health workers from various departments in various rounds.

As a result, some nurses working in the paediatric department demonstrated an interest in newborn care activities and were receptive to receiving the standard training being offered. Dr Lamesgenew then contacted Dr Mulualem and it became possible to train three nurses for six weeks on the recognised NICU nurse training course in Addis Ababa.

Although the plan was to establish the NICU as soon as the trainees returned to the hospital, it took them six more months to do so. In the meantime, these nurses tried to create a corner within the paediatric ward where newborn babies could be cared for. Subsequently, they were able to temporarily secure a small room within the paediatric ward (formerly used to isolate meningitis cases) for keeping and treating neonates with medical problems, which could accommodate four beds. These dedicated nurses made an informal exploratory visit to various departments and units of the hospital to look for equipment that could help establish a newborn care unit. They obtained a heater from the hospital Providers Initiated HIV Counseling and Testing (PICT) unit and found blankets in the store that the hospital had received from a recently closed NGO. During these days, NICU-trained nurses and others were assigned, in rotation, to the paediatric ward to look after newborns. Although this effort had some effect in reducing complications as well as the mortality of newborns, due to insufficient care and follow-up, as well as lack of essential equipment and non-septic conditions, the change was not up to the desired level.

Six months later, after intensive lobbying and proactive support from the head of the zonal health department, the hospital management decided to allocate one relatively large hall to the future NICU, formerly used as an adult tuberculosis isolation and treatment room. In consultation with VSO Ethiopia volunteers from Yirgalem and Dr Mulualem from Addis Ababa, this hall was refurbished and partitioned into four small rooms – nursing-assessment room, hot room, non-septic room and KMC room – and one room for mothers to stay in. Lessons had been learned from the experience of establishing the Yirgalem NICU and led to the location of rooms to ease patient flow and the allocation of spaces for different services. Further such lessons were applied when installing basic structures such as water supply, and electricity as well as equipment with better functionality such as neonatal resucitaries and heaters locally produced in Hawassa.

The advancement: Arba Minch

In September 2012, Dr Jo Cryer, a paediatrician and volunteer from the UK, joined the paediatric department in Arba Minch. In October 2012, another VSO volunteer, Dr Andrew Cornish, a GP, was placed in Arba Minch. Both placements were funded by UNICEF, and the objective was to improve child mortality, with particular focus on reducing the neonatal mortality rate.

As part of an initial needs assessment to ascertain the neonatal mortality rate in Arba Minch hospital, they collected data on admission to the paediatric ward for the eight-month period 1 August 2004 to 10 March 2005 (Ethiopian calendar). A total of 1,332 admissions were reviewed, and the records showed a neonatal admission rate of 4.8% of total paediatric admissions, with a neonatal mortality rate of 175 per 1,000 admissions (17.5%). After the NICU was established in Arba Minch, neonatal admissions increased by over 300% to 15% of total paediatric admissions, with a fall in neonatal mortality despite the huge rise in the number of sick babies now admitted.

After meetings between the senior programme manager for health at VSO, the hospital CEO and the dean of Arba Minch Medical School, a consensus was reached on the merit of establishing a neonatal unit and giving training to health workers, particularly nurses. Three nurses working in the paediatrics ward were selected based on their commitment and competence. They underwent the six-week standard training in the management of newborn care, by Dr Mulualem and Professor Bogale at Yekatit 12 Hospital, in Addis Ababa, financed by UNICEF. Later, two days' training in neonatal resuscitation was given to over 50 health workers to increase the workforce for newborn care. At Arba Minch the establishment of the NICU was financed by Irish Aid. As large numbers of newborn babies came to the unit, the need for more equipment became evident.

Following on the experience at Yirgalem, local equipment was sourced, saving money and meaning the equipment could be maintained locally, unlike imported equipment. Again based on the relationship already established by Dr Toby and Dr Liz (VSO volunteers working at Yirgalem hospital), Metal Fabricators in Hawassa were approached to produce equipment for the NICU. Improving on the Yirgalem and Hossana experience, the new design better incorporated phototherapy units and heaters into one unit that can be easily mobilised from place to place. This modification not only improved the functionality of the equipment but also reduced the production cost. However, items that cannot be produced locally, such as oxygen concentrators, were purchased through the hospital with the support of the hospital pharmacy manager.

The NICU in Arba Minch was able to learn from the experiences of Yirgalem and Hossana, and is now considered a centre of excellence. Other hospitals look to share experience with, and draw lessons from it.

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The process

The establishment of the NICUs in the three hospitals had three interrelated stages: (1) designing and refurbishing the proposed area; (2) equipping the unit in order for it to fully function as a NICU; and (3) arranging a training course in neonatal care and resuscitation for selected hospital staff, thereby improving neonatal care within the hospital and making colleagues aware of the benefits of neonatal care alongside extended training of nurses to work in the NICU under Dr Mulualem and Dr Bogale in Addis Ababa. Furthermore, after the establishment of the NICU, different standards and guidelines were produced to facilitate provision of quality newborn care.

The refurbishing required utilising the space offered by the hospital management in order to maximise the capacity as cost-effectively as possible, based on the current structure of the rooms and in discussion with neonatal trained nurses and concerned hospital authorities. The rooms were partitioned to provide separate septic and non-septic areas, rooms for KMC, and a nurse station (assessment room). Electricity and water supplies were installed without disturbing the basic structure of the rooms. In Arba Minch, windows were installed between the three rooms so that nurses in the assessment room can constantly observe babies in both rooms and spot any alteration in their condition.

Arba Minch NICU non-septic room

The equipping of the NICU involved first compiling an inventory of equipment, material, and supplies, with the estimated budget that would be proposed to donors. It was imperative to be as cost-effective as possible, and doing so required paying repeated visits to the Pharmaceutical Fund and Supplies Agency (PFSA). Another means to ensure cost-effectiveness involved substituting expensive imported equipment by innovating local equipment designed by volunteer doctors in consultation with Hawassa TVET. This equipment has proved to be sustainable and simple to operate, for it is less likely to break and is easily repaired and maintained. Such equipment included heaters, phototherapy units and resuscitaires. Using equipment that was under-utilised or that was stored without knowing what it was for, repairing equipment that needed maintenance and even some that had been discarded as useless, and obtaining material from other departments in the same facility or from other facilities[4], resulted in a very cost-effective solution.

Training: There were three types of training: the TOT, the two days' training, and the standard EPS six weeks' training for NICU nurses, provided in different modalities as appropriate to the local situation.

ToT course in neonatal resuscitation and essential newborn care, Yirgalem

At the start of the whole cascade establishment of NICUs, the VSO volunteers offered a three-day ToT for GPs and head nurses, who later helped to provide the two days' training to midwives, paediatric nurses, GPs, anaesthetists and health officers.[5] In Yirgalem the two days' training was provided prior to the selection of the potential NICU nurses who were later sent to Addis Ababa for six weeks' training. Thus, besides the obvious

[4] At Arba Minch the oxygen tanker regulator was not functioning and could not be repaired. The head pharmacist came across a regulator while visiting the store of Arba Minch health centre and brought it to the NICU, having done an exchange deal for it with the HC centre.

[5] Junior doctors and even most paediatricians in Ethiopia have little training in neonatal care and frequently rotate jobs, so sometimes the nursing staff need to guide doctors and ensure the smooth running of the neonatal unit.

purpose of orienting health personnel in neonatal care, it is assumed that the strategy has contributed to two important achievements, the first of which was to help the trainers select outstanding and dedicated potential NICU nurses who were to be sent to Addis Ababa for six weeks' training.

Health workers who received the two days' training, NEMH

The second, but probably not openly claimed (and maybe even unintended), purpose was to deal with the resistance of the hospital's medical community by awareness-raising, discussion and open involvement in critical issues.

In Hossana, the course material included lectures and manuals which were slightly adapted from the previous course to make them more specific to NEMH. This training course, unlike that at Yirgalem, included a pre- and post-test as well as training evaluation and feedback forms in Amharic.

In Arba Minch the two days' training was given after the NICU nurses finished their six weeks' training and while the NICU was in the process of being established. The selection of nurses for the standard training was therefore based on their activities in work related to neonates and the paediatrics department, where they were working with and under the supervision of the two VSO Ethiopia volunteers. A total of 47 health staff personnel from Hossana, 300 from Arba Minch[6] and 53 from Yergalem completed the two-day course. Key training messages included criteria for NICU referral, neonatal resuscitation and immediate management of sick neonates.

The six weeks' standard training:

Four nurses from Yirgalem hospital, three from NEMH and three from Arba Minch hospital were trained in neonatal care for six weeks. Dr Mulualem, the neonatologist in Yekatit 12 Hospital, managed the training using the EPS course designed by her and Professor Bogale. The training is appreciated by all stakeholders and enabled the trainees to capably handle neonatal cases. The FMoH newborn care training course and the EPS training manuals for NICU nurses run at the Black Lion hospital in Addis have been used as training resources.

The trainees, especially those in Yirgalem hospital and NEMH, gained practical knowledge not only of handling sick neonates but also of other activities such as the operation and minor maintenance of equipment under the mentorship of the VSO volunteers and NICU nurses. Most importantly, the NICU nurses learnt a lot from the volunteers, such as commitment and devotion to one's work, compassion for neonates, perseverance and problem-solving, all of which are essential for saving the lives of newborns.

Preparation of guidelines and manuals:

Guidelines on different aspects of neonatal care were prepared to serve as a means to ensure uniformity in the execution of quality services, and as a bedside teaching instrument. Furthermore, as an aide-mémoire for nursing staff and GPs, laminated algorithms for various practices such as assessment protocols, steps in newborn baby resuscitation, vital sign monitor, drug information and others are posted on the NICU walls. This system has worked very well and has contributed to the smooth running of intensive care activities, better performance and outcomes.

Major issues displayed on the walls include admission criteria, medication doses and procedure steps for providers, and notices that remind mothers/caregivers of important practices such as hand-washing, rules for accessing non-septic and hot rooms as well as ways of keeping the baby warm using KMC techniques. VSO volunteers also approached a local artist to draw culturally specific pictures of women performing KMC which are used as posters in the unit in Yirgalem hospital and NEMH.

[6] The trainees in Arba Minch included medical students from Arba Minch University School of Medicine

Summary of best practices

Capacity building, knowledge and skill transfer

- VSO built the capacity of the hospital staff to manage neonatal care by organising a two-day training course on neonatal resuscitation for all nurses, GPs and other professionals concerned with caring for newborn babies. In Yirgalem a three-day ToT has also been given
- Nurses engaged to work on the new NICU units had the benefit of a six-week course for NICU nurses developed by the EPS and run at the Black Lion hospital in Addis, sponsored by their individual hospitals and the Health Bureau
- The VSO volunteers prepared (adapted) normative and Standard Operating Procedure (SOP): guidelines, protocols, manuals, algorithms, flowsheets, admission criteria, etc. They also adapted management protocols, such as monitoring of glucose level, drug chart, etc
- They established supplies and medication compartments for emergency care – emergency box, intermittent box and NICU mini-store – to ensure that newborns needing emergency medication receive treatment without the delay that can occur when the responsible family member has no money to hand to pay for treatment
- A vibrant mutually supportive and consultative environment was established among the various units of the hospital that have contact with newborns, such as the outpatient department (OPD), obstetrics, paediatrics and NICU[7]. This helped newborns to quickly and smoothly reach the NICU for life-saving management, the sharing of available resources such as drugs and other supplies, etc

Mentorship

- The VSO volunteers implemented the transfer of knowledge in the form of mentorship and teaching by doing, besides formal classroom training. This included simulation scenarios and problem-based learning while introducing and encouraging an evidence-based approach to medicine
- NICU staff were also trained to operate machines and equipment and make use of instruments that originally had a different purpose
- They also learnt to maintain equipment – instruments essential for a NICU such as heaters, oxygen concentrator, cylinder gauge, etc

Cultivating commitment, conscientiousness and perseverance

The initial stage of the establishment of the NICUs, especially in Arba Minch and Yirgalem, was full of challenges that would have aborted the entire project had it not been for the determination and perseverance of the volunteers as well as the potential NICU nurses and some health professionals outside the unit. The commitment, conscientiousness and enthusiasm of the VSO volunteers inspired, and was reflected in the perseverance, of the nurses

- Nurses worked eight-hour shifts for months without interruption, with no thought for their personal and social commitments, in a physically and professionally demanding situation, with no financial gain (such as overtime pay) or even services (such as tea or coffee, for they cannot leave the NICU room unattended for a minute during the eight-hour shift)
- Problem-solving capacity – technical: NICU nurses were observed to do everything humanly possible to save the lives of the newborn, even under very arduous circumstances and against all odds (in the absence of paediatricians or physicians, in situations where desperate and frantic mothers were unwilling to breastfeed or to give KMC or abandoned their sick babies, or there was shortage of supplies and general support)
- Problem-solving – non-technical: NICU nurses now have the courage and confidence to raise concerns with their superiors including zonal health authorities as well as local facility authorities
- Requests from staff are proactive and persistent (from hospital management for improved working environments such as additional rooms, etc; from directors for additional staff and supplies; from pharmacy for NICU-specific supplies such as micro-needles, small sized NGT, etc; from general services for unskilled labourers, maintenance of basic infrastructures such as electricity, water supply, etc

[7] Previously it required a conscientious obstetrician to step outside his/her remit and start treatment on neonates, and this treatment may not always have been the most appropriate. Now these babies are flagged up, and neonates who require paediatric review are referred by the obstetric team by instigating a referral form. By opening a NICU the obstetric department are aware that we have a special unit to take babies who are septic or have any other medical concerns, and this has greatly improved care.

Innovation

- Locally available materials are used to produce essential equipment for the NICU (eg resuscitator, incubator, phototherapy, heaters from TVET) that is cost-effective, simple to use and not reliant on complex maintenance
- An interdepartmental relationship has been established. After a needs assessment, showed that there was little or no communication between the obstetric and paediatric departments, a mechanism was established for much improved communication and a mutual understanding and support system. Previously it required a conscientious obstetrician to step outside her/his remit and start treatment on neonates, and this treatment may not always have been the most appropriate
- Supplies and medication compartments for emergency care have been established: emergency box, intermittent box, and NICU mini-store

Valuing research

- VSO volunteers conducted rapid assessments in these hospitals prior to intervention which helped to identify pressing health needs of the newborn babies on which the intervention was based on the one hand, and which serve as a benchmark against which post-intervention achievements are gauged, on the other hand. In a country where research-informed intervention is rare, the experience deserves to be called best practice
- The volunteers have utilised available data including facility service statistics in preparing the project proposal to be submitted to VSO Ethiopia to secure funding from the VSO Ethiopia project budget for the establishment and strengthening of NICUs.

Documentation

- Establishing a mechanism for documenting routine statistics including admission and outcomes such as discharge and death which cannot be captured by the HMIS section
- Posting all available data and figures in a vivid and informative manner on the wall that is easily visible to all
- Posting protocols and flowcharts which are critically needed for routine clinical management, such as life-event monitoring charts
- Local adaptation of management protocols, such as monitoring of glucose level, drug chart, etc

The project activities gauged against the major criteria of best practices

Relevance of the project/the intervention logic

Ethiopia has a high neonatal mortality rate which in turn greatly influences infant and child mortality. The situation in the targeted hospitals was no different. The rapid assessments conducted by VSO Ethiopia volunteers in order to gauge the magnitude of the problem confirmed this reality. For example, before the establishment of the NICU, the Arba Minch hospital data showed a neonatal mortality rate of 175.4 per 1,000 live births compared with a national average of 37 per 1,000.

In view of the small sample numbers, the statistical significance may be minimal, but the figures do suggest that a focus on neonatal care at Arba Minch hospital was a great priority[8]. The findings of the needs assessment in the other two hospitals were also broadly similar and demonstrated the need for action. Subsequent outcomes have shown that the establishment of a NICU supported by appropriate staff training has a beneficial effect.

In light of these facts, it is reasonable to conclude that the project is relevant and the intervention logic valid. The project is also consistent with external reality, which includes international commitment to newborn care, national and regional government policies, administrative capacities or institutional and cultural factors as well as living conditions of the target group(s).

Why so little regard to neonatal care? The relevance of the project can be further justified when seen in the light of the major causes of the high neonatal mortality rate, including:

- Sick neonates went unnoticed on the obstetric ward

[8] Approximately 200 births occur per month, but estimating mortality on the labour ward was difficult as only stillbirths or intra-uterine deaths were recorded.

- The majority of high-risk cases had no paediatric review at any time
- Knowledge that active intervention could significantly change the outcome for these babies was lacking.
- There was no access to heaters, phototherapy or respiratory support
- There was a lack of knowledge and skills in neonatal resuscitation and newborn care among all health professionals
- Communication between obstetric and paediatric teams was poor
- Staff felt that the paediatrics department lacked the ability to manage sick babies, so would not refer

Effectiveness

The NICUs on all three sites successfully achieved their purpose by providing live-saving intensive care for newborns who are in critical need of intervention, such as maintaining normal body temperature and breathing, hypoglycemia, and infection prevention.

The project has produced the desired results and there is sufficient information, data and material to verify the results achieved. Thus, though the degree of success may vary slightly from hospital to hospital, the project has been effective in reaching planned results and bringing planned changes, of which the main one is a reduction in neonatal mortality.

This was confirmed by the testimonies of the management of the hospitals, the heads of zonal health departments, paediatric staff, the VSO volunteers and the NICU staff themselves.

Efficiency – cost effectiveness

Utilisation of resources in general (funds, expertise, time, etc) as well as inputs used to undertake activities was efficient. For example, equipment and instruments that would have been expensive were locally produced at a very low price for all three hospitals. Some of the basic equipment (resuscitaire, phototherapy, radiant heater) has been made locally by the TVET institutions. This locally substituted equipment is not only less costly but also can easily be replaced (as it uses simple bulbs) and repaired. Moreover, the suppliers offer to provide technical support if any of the equipment fails. Using locally made equipment saved the project huge sums of money, which enhances its cost-effectiveness, sustainability and scalability. For instance, an imported phototherapy machine without a bed costs 27,000 birr and with a bed costs about 60,000 birr, but the machine with the bed was locally replaced for only 3,500 birr, and an imported resuscitaire costs 32,000 birr while a local one costs only 12,000 birr. Thus the project saved about 56,500 birr and 20,000 birr per single phototherapy machine and resuscitaire respectively.

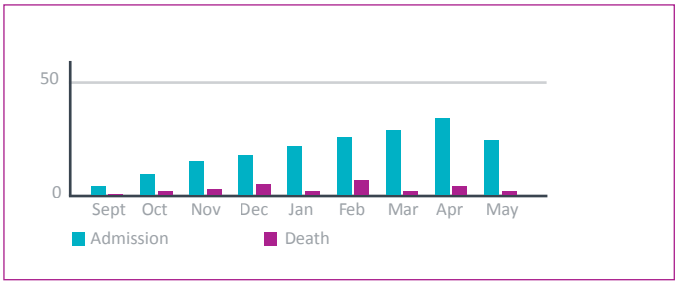
Furthermore, project expenditure reports and records were sufficiently well prepared to guarantee transparency and to make an analysis of the costs incurred to reach the results obtained. Thus the objectives were achieved at minimal cost (or at the lowest possible cost), and the results or benefits justified the cost. In short, the investment was worthwhile for the achieved results.

This experience demonstrated that establishing a NICU is not primarily constrained by lack of money but by lack of initiative and commitment by the relevant medical personnel. Local substitute equipment was cost-effective and sustainable. The materials are easily replaced as they involve simple bulbs, and the suppliers have offered to provide technical support if any of the equipment fails.

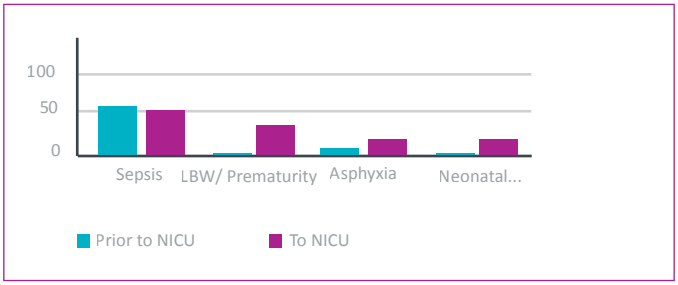
Impacts

- Meeting the unmet need: Neonatal admissions are increasing and newborn deaths decreasing. In all the hospitals the unit has had a very clear impact. At Arba Minch, over an eight-month period prior to NICU establishment, the neonatal admission rate was 4.8% of the total paediatric admissions. This number has increased threefold to 15% since the unit has opened when monitored over a five-month period.
- Reduction in hospital neonatal deaths: Neonatal mortality was 17.5% prior to the NICU opening, and within a five-month period this has reduced to an average of 15% (and 10% in three of the five months assessed)[9]
    - In Yirgalem, neonatal mortality fell from 18.5% to 6.45% in December 2012
    - Prior to NICU establishment, premature/LBW babies were not routinely referred. Babies with asphyxia or neonatal tetanus were also unlikely to be referred by the obstetric team or OPD. In Arba Mminch, 25 babies weighing less than 2kg survived within the first five months of the establishment of the NICU
    - Mortality rates of neonates admitted have also shown a significant and sustained fall
- Expansion of neonatal care units: the training of nurses from Jinka, Saula and Gidole hospitals demonstrates interest from other health facilities and the ability of the unit at Arba Minch to be used to train staff for, and help in the establishment of, other NICU facilities, thus helping more babies
- NICUs have established a direct referral linkage between the delivery and outpatient units of the three hospitals without going through the formal referral path to facilitate easy access for newborns who need life-saving emergency care

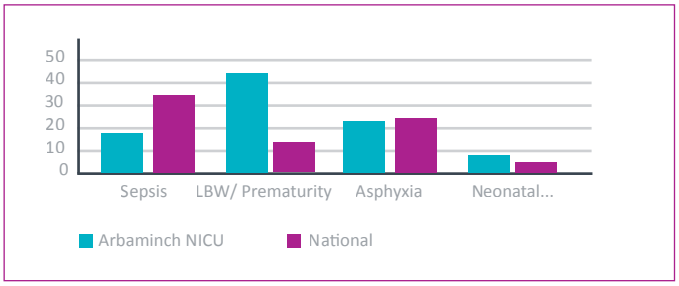
Nine months neonetal admission and death, NEMHH



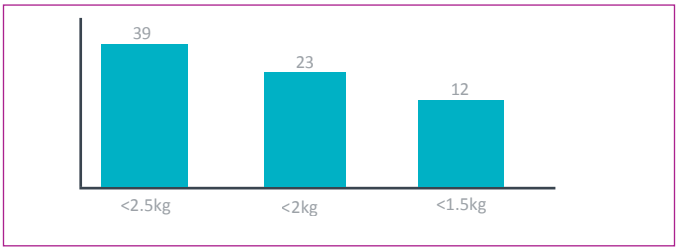
Causes of neonatal admision before and after NICU Arbaminch



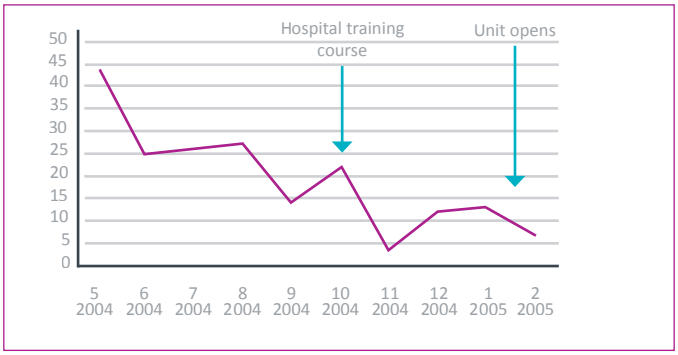
Causes of neonatal mortality



Weight profile of neonates admitted in Arbaminch NICU



Reduction in mortality rates at Yirgalem per month during VSO fellowship



Sustainability

There is adequate evidence to show the sustainability of the project benefits once external support is withdrawn. This is because the project is supported by local institutions and is well integrated with local social and cultural conditions. The following are the main factors that ensure sustainability:

- Hospitals do not need new staff to start a NICU, and those to be trained are permanent employees of the hospital
- The training of all staff on neonatal resuscitation has helped create awareness of and win support for the project
- Guidelines will serve as easy references to old and new NICU nurses. At policy level, neonatal care is now a nationally upheld strategy (as clearly expressed in the HSDP IV and the Growth and Transformation Plan), and political and financial support by the government is very likely to continue
- At global level, the achievement of MDG (3 and 4), is greatly dependent on a decrease in neonatal mortality and there is high donor-development partners interest.
- Currently, a new directive for cascading training, setting Monitoring and Evaluation protocols and the intention to incorporate into the HMIS is under preparation, ensuring continuity of the intervention
- This is a low-cost but high-impact intervention relying on locally produced equipment, furniture and material
- Little medication or other supplies or pharmaceutical commodities are required other than those on the essential drug lists of a hospital already in use
- Theommitment of the leadership at the zonal health department and facility management levels is expressed by the assignment of more staff than the number that the Business Process Reengineering allows

Replicability

The cascade effect:

- The establishment of the Yirgalem NICU created the stimulus for the establishment of a similar unit in Hossana, which in turn led to the founding of the Arba Minch NICU, with some improvements based on lessons learned from previous experiences. Arbaminch NICU provides a two-day training to various categories of health workers in the three neighbouring hospitals, namely Jinka, Gidole and Saula, and two nurses from Gidole hospital also had a one-month internship attachment . The head nurse of Arba Minch NICU and the two VSO volunteer doctors have developed an updated list of the basic equipment, instruments and other supplies needed to establish a NICU in Gidole hospital. Once the rooms are arranged, and renovation is underway, the Arba Minch team will facilitate the procurement and installation of these materials for the opening of the unit, and will continue mentoring thereafter. The Arba Minch team also hosted an experience-sharing programme for the medical director and the CEO of Gidole hospital to demonstrate what a NICU looks like and how simple it is to establish if there is the will from above and of staff and management to work together.
- NICUs have established a direct referral linkage between the delivery and outpatient units of the three hospitals without going through the formal referral path, to facilitate easy access to newborns needing life-saving emergency care
- Arba Minch NICU gained recognition as a centre of excellence for sharing experiences with hospitals and NICUs elsewhere in the country. Nurses working in Bahardar NICU have come to learn from the experiences of Arba Minch NICU, especially on making use of local establishments, such as Hawassa TVET, to produce low-cost newborn beds with heater and phototherapy in one package. The likelihood of the establishment of NICUs not only in Gidole but also in Saula and Jinka is very high
- These episodes clearly indicate the replicability of the project

[9] In three of these five months the mortality has actually been under 10%, with the results being skewed due to two months where the mortality was 25%. This happened in months two and four after the unit opened. The initial spike can be attributed to the dramatic surge in admissions combined with poor staffing levels.

Contribution to personal motivation of hospital staff

- Besides the nurses who volunteered to take the training and work in the NICUs, other health personnel are motivated to learn and work in the area of neonatal care. Dr Meskerem Abathun (NEMH) and Dr Rahel (Yirgalem hospital) are recently graduated GPs who took the two-day training and are now working closely with the NICU. They developed a passion for neonatal care and would like to specialise in paediatrics with a sub-specialisation in neonatology. This motivation, they said, came from their experience in the unit
- The NICU nurses' enthusiasm not only to enhance their current service and commitment, but also to upgrade their educational status with a specific focus on neonatal care, is another case in point

Ethical soundness

- The project activities respected the current rules of ethics for dealing with human populations, and are in line with the principles of social and professional conduct

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Lessons learnt

The following lessons were learnt from the project practice:

- The most important element in ensuring the success of the project, or indeed any project, is the commitment of the project staff. Commitment begets perseverance and perseverance pays
  "No amount of equipment in the world could have guaranteed the success of the neonatal unit. The real success and sustainability of the venture lies in the motivated nursing staff. Along with being competently trained they show great skills in compassion and taking the initiative."
  Dr Jo Cryer
- Motivated trained neonatal nurses were key to the implementation and sustainability of the project
- The commitment of the Arba Minch zonal health department played a significant role where NICUs were established
- Once the hospital staff realised there was a separate area to care for neonates, admissions increased dramatically
- Improved adherence to guidelines for simple problems led to improved outcomes in areas including hypothermia; hypoglycaemia; supporting poor feeding with expressed breast milk (EBM) via nasogastric (NG) tube; sepsis; respiratory distress; seizures; and jaundice
- Strict hand-washing policies in NICUs and prompt initiation of antibiotics has minimised the number of cases of babies deteriorating due to sepsis
- When the emphasis is on healthworkers' competence through training, simple interventions save lives
- Premature, preterm and LBW babies were rapidly transferred to the NICU where they were kept warm under a heater or with KMC
- Improved documentation is essential for providing safe care to vulnerable babies
- Setting and utilising an appropriate referral system plays a significant role in saving the lives of neownates
- Challenges can come from unexpected quarters such as from senior health professionals within the same facility
- Making the responsibilities and hierarchy clear during the tripartite agreement has been found to be extremely important for patient safety. Each person's role and responsibility should be explained to the people they will be working with. For example, the place of the volunteer paediatrician in the technical/professional and administrative/logistic line of command should be clear in such a way that in all clinical matters volunteers are answerable to the specialist paediatrician assigned as a head of the paediatrics department and not to GPs with less clinical experience

Opportunities and challenges

The major opportunities that in one way or another contributed to the success of the project can be summarised as follows.

Opportunities

Policy level opportunities: An enabling attitude, political and financial commitment at international as well as national levels created an environment in which interventions, both customary and innovative, can be implemented.
The MDG along with the donor-development partner's interest, the GTP and HSDP IV are the most important opportunities that can be exploited maximally.

Individual: The personal devotion and commitment of a few, along with action-oriented and result-focused individuals, creates an immense opportunity not only to initiate but also to boost enthusiasm and the courage to overcome all challenges to their aspiration, which is to save the lives of innocent souls. The project's success has depended on

- the Commitment and efforts of Dr Mulualem
- the support of the zonal health department (Arba Minch)
- the commitment of Dr Lamesginew, the paediatrician (Hossana)
- the commitment and perseverance of VSO staff (all hospitals)
- the perpetual and ever-increasing commitment and altruistic motives of the NICU nurses

Challenges

As in many health interventions, challenges may arise from various sources including the institutional/organisational culture and traditional way/system of doing things, a lack of capacity (infrastructure, supplies and Human Resource of Health), objections to the nature of the intervention, as well as individual motivations of either ignorance or resentment. The main challenges the project faced include:

- Workload of the nurses, mainly due to shortage of trained NICU nurses in all hospitals since the inception of the programme
- Lack of support for, or a delayed response, from the authorities in, the provision of essential health commodities for the NICU and the facilitation of routine functions was observed in one of the hospitals. Sometimes the hospital management appeared not to recognise the NICU as a separate unit from paediatric services and denied the necessary and critical support it needs
- Thinking beyond paediatrics is a new experience for most medical staff, reflecting of the community view, according to which neonates are either not considered human or, if counted at all, are regarded as young children
- Absence of paediatricians in some of the hospitals to consult for difficult cases. In Yirgalem, currently there is no paediatrician to be consulted and the unit relies on GPs working in the paediatric department. Fortunately the assigned GP is so dedicated that she visits the NICU twice a day
- Shortage of equipment (eg lack of incubator in Hossana), and supplies (eg reagent to test bilirubin level in Yirgalem)
- Small rooms with insufficient space to carry out standards practices, a situation that is particularly serious in Yirgalem
- Lack of rooms: There is no room for mothers of newborn to stay in, and this created a problem in ensuring the non-septic room is truly non-septic, as mothers or caretakers frequently enter the room to feed their babies
- The location of the NICU with reference to important services such as delivery and OPD created logistical problem in some cases. For instance, in Yirgalem the NICU is located far from the obstetrics ward, which creates inconvenience and risk when carrying newborn babies with serious medical conditions such as respiratory distress or apnea for emergency care as well as for seriously ill or operated mothers to feed their newborn admitted to the NICU. In Arba Minch, transporting the oxygen cylinder has become a burden, as the store for such equipment was far away from the NICU
- Lack of continuous upgrading or updating of knowledge and skill in the management of newborn care since the initial training. Those nurses that were added to the units to support NICU nurses did not receive the standard six weeks' training. There was also no supportive supervision from either the RHB or the FMoH
- Resistance to or outright objection to the project that aimed at establishing NICU by some hospital authorities
- Though the VSO Ethiopia volunteers have reported remarkable working relationships with the great majority of Ethiopian counterparts, several awkward situations arose when it came to working with some of the hospital staffs, including GPs and some specialists
- Rigid hierarchy among the medical professionals, whereby nurses could on no account train doctors (even junior GPs)
- The very small number of newborn babies reaching NICU for life-saving services may have limited the impact achieved since its establishment. This is due to traditional and cultural beliefs about and attitudes towards newborn babies, which influence the type of care preferred for sick babies, compounded by a low level of institutional delivery

Beyond NICU… demand-creation work in the community

Besides the above-listed technical/medical factors, some cultural factors also contribute to the widespread inattention to neonatal care. According to Charlotte Warren, many women in Ethiopia do not seek formal healthcare during pregnancy, childbirth and puerperium. This has a major impact on care-seeking for, and survival of, the newborn. Less than a third of women receive antenatal care, and at birth most are assisted by unskilled attendants (Traditional Birth Attendants and relatives) since over 80% of Ethiopians live in rural areas, where traditional beliefs influence prevailing attitudes and practices more than do government policies. Most women perceive divine purpose to be the overall deciding factor. Religious or spiritual explanations deflect direct blame from the mother or birth attendants, but may reinforce inappropriate practices or responses to morbidity. Many women believe that stillbirths are caused by evil spirits that are out to claim and kill newly born babies and that some babies die after they are born because 'it is the will of the Lord' or may be affected by the strong rays of the sun. Malevolent spirits are frequently cited as causes of neonatal morbidity, and the response will often include a spiritual element.

Herbal medicines are a widespread response to morbidity, and may be used alone or as a complement to spiritual and/or formal healthcare options. Mothers tend to seek facility-based healthcare only if the newborn develops an illness that does not respond to initial 'informal treatment'. Moreover, tradition compels the mother to stay at home for 40 days after birth, and this restriction of mobility has negative implications on newborn check-ups and seeking care if the newborns fall sick.

Informants in Arba Minch and Hossana also observed that people perceive prematurely born babies as not fully human. There is not even a funeral ritual for dead neonates. There is no mourning, relatives and friends living elsewhere are not told, and the Idirs (traditional funeral associations) are not requested to do what they would had the deceased not been a neonate. In general, the religio-cultural and socio-economic environment influences maternal and newborn health through community beliefs and practices. Understanding the context of such beliefs and practices is central to developing strategies to ensure positive outcomes for both the mother and infant.

The way forward

Based on the results of the assessment, the following points need to be addressed:

Strengthening already established NICUs

- Ensure motivation schemes exist and reward best-performing institutions and individuals
- Fully recognise the hard work of NICU nurses non-monetary incentives such as a letter of recognition, provision of tea and coffee at workplace, etc, can be important)
- Enhance networking coordination among paediatrics and obstetrics departments
- Find new ways to incentivise NICU nurses, in order to maintain their current commitment and enthusiasm, eg by design an appropriate career structure
- Hospitals must take ongoing responsibility for maintaining equipment, restocking supplies, and ensuring adequate staffing and space to cope with increased admissions
- Establish psychosocial support and counselling services for mothers of neonates within the hospitals by recruiting "social workers" or providing specific training to counsellors
- Establish access to updated knowledge and information about newborn care through electronic and print media.
- Train and assign additional NICU staff
- Improve the NICU referral system by redesigning referral forms to be more interactive, with documentation and analysis of the referred, and review and periodic updating of the NICU referral and admission criteria

Expansion of service

- Establish a NICU in every hospital – this will save the lives of lots of newborns and relieve the burden on the country in terms of child mortality
- At woreda and zonal health offices/departments, use fora such as review meetings for promotional work. At regional level it might be possible to highlight the contribution of NICUs to the reduction of neonatal mortality and hence overall child mortality
- Share experience with other zonal health offices to establish similar programmes to increase community access to newborn care services (within their reach) and to reduce the workload of the already established NICU
- Provide accelerated and cost-effective training. Lessons could be drawn from the experience of training Health Officers (HOs)
- Finalise and disseminate guidelines (implementation and recording)
- Regarding drugs and supplies, there should be a NICU-specific item line (budget allocation)
- Link the NICU with the family neonatal care programme put forward by HSDP but which is not actually working very effectively, and establish a direct referral system from HPs to NICUs by orienting HEWs in admission criteria

Demand creation:

- Mobilise the community against unhealthy traditional attitudes and misconceptions about neonates and creating demand for institutional care using HEWs and community conversation sessions
- Religious or spiritual figures in the community play a symbolic role in sustaining the health of the community, and so cannot be ignored in interventions, to which their support and cooperation will lend validity

Appendix I: Success stories

Dr Jo Cryer

Rahel, our health programme manager from VSO, came to visit Arba Minch hospital in December. On a tour of the hospital I showed Rahel the delivery room and the resuscitaire that we use to revive sick babies. This is a sophisticated piece of equipment, donated a long time ago by an NGO, and is not well maintained. The midwives had also reported to me that they were unaware of how it worked. The heater in the delivery room had been left on, accidentally it seemed, but when I took a closer look there was a tiny baby, bundled in loose covers, struggling to breathe. Nobody had alerted the paediatric team and nobody was offering the baby any supportive care . The baby had been left on the resuscitaire as no one held out any hope for it because it was presumed to be too small to be viable. However, it transpired that the baby had been born more than 12 hours previously so was clearly a fighter and hanging onto life, despite the lack of supportive interventions.

I found an Ambu bag and started ventilating the baby as the heart rate was slow. Dr Andrew joined us and we took turns to ventilate the baby with the bag and mask. The heart rate dropped below 60 beats per minute a few times, so we gave cardiac compressions and the baby responded. Slowly the facts trickled through. The baby was one of triplets and weighed 1.5kg. The first triplet was a stillborn and the other two had been placed on the resuscitaire, providing heat but no other support. As I wrapped the sheets around the baby I discovered one of the dead triplets at its feet. Dr Andrew went to fetch Solomon, one of our neonatal nurses who had been on the six-week training in neonatal care in Addis. We set about trying to establish a temperature, but found the baby was too cold for this to register, despite being under the radiant heater. The oxygen saturations were 90% with continuous bagging.

I wanted to prescribe intravenous fluids and antibiotics and so asked one of the midwives to take over bagging the baby. It became apparent that this was something she had never done before. We taught her and a few other midwives who were standing by how to ventilate the baby. This highlighted the importance of rolling out neonatal resuscitation training to all our midwives. I called Dr Yiheyis, the paediatrician, to come and review the baby. He was understandably disappointed that a baby had been left for 12 hours struggling to breathe while no support was offered nor anyone from the paediatric team contacted to review the baby. Dr Yiheyis inserted an NG tube into the umbilical vein to gain access to give fluids and antibiotics and gave instructions to the midwives to bag the baby every 20 minutes. We could not provide this baby with continuous ventilation with a bag because without continuous positive airway pressure (CPAP) or a ventilator we have no other way of supporting such babies, so we needed the baby to show some independent effort of breathing. Now that our NICU is established, babies like this will have an extra chance by being given a trial of CPAP, which helps to keep the airways open and is particularly useful in premature babies and when babies with respiratory distress become tired.

It was also important to take into account that this baby was 12 hours old before we reached it, so the potential for hypoxic brain damage was huge and the chances of a good outcome were negligible. The baby unfortunately died three hours later. We cannot know whether effective resuscitation from birth and early transfer to a fully functioning NICU with well-trained staff might not have completely changed the outcome, but it would certainly have given this baby the optimal chance of survival and the mother might have been able to take home at least one of her three children. A learning point for all staff involved was to give every baby the best chance of a positive outcome, through active resuscitation, prompt referral and intervention.

Dr Jo Cryer

As part of the initial needs assessment it quickly became apparent that there was little or no communication between the obstetric and paediatric departments and that this was an area that needed to be improved. The obstetric team used to often start antibiotics on babies that they felt showed signs of sepsis, without consulting a paediatric opinion. This led to inadequate care of such babies,

a lack of consistency with regard to which babies should receive antibiotics and the duration of these antibiotics, and a lack of appropriate supplemental investigations and supportive care. Reviewing daily any babies that the obstetricians or midwives are concerned about has changed practice on the obstetric ward. It has allowed early opportunistic intervention.

For example, one day when visiting the obstetric ward the midwives alerted us to a baby who had developed pustules around the umbilicus that looked infected. As the baby was feeding well and otherwise behaving normally, the midwives were not too concerned and only mentioned it because Dr Andrew and I were asking to see any babies that they had queries over. While the baby did indeed appear to be otherwise well, the pustules and red flare around the umbilicus were signs of umbilical sepsis which needed prompt treatment with intravenous antibiotics. We started the baby on appropriate antibiotics and, because antibiotics were started as soon as the infection was noticed, the baby responded very well and made a complete recovery.

Our visits to the obstetric ward have shown that we are interested in reviewing babies that the midwives and doctors are concerned about and that timely interventions can dramatically improve outcome. Such opportunistic encounters have led to a change in the culture of treating such babies. Previously it required a conscientious obstetrician to step outside his/her remit and start treatment on neonates, and this treatment may not always have been the most appropriate. Now these babies are flagged up, and neonates who require paediatric review are referred by the obstetric team. Now that we have opened a NICU the obstetric department are aware that we have a special unit to take babies who are septic or have any other medical concerns and this has greatly improved care.

Early in our placement, a pair of twins born at 32 weeks' gestation were admitted to the ward. Despite being born vigorous and well, both died within the first week of life. The reasons for this were numerous: incorrect fluid prescriptions, lack of appropriately sized cannulas, lack of clean hygienic surroundings and lack of respiratory support other than oxygen via nasal cannulae.

It was this clear lack of knowledge among all the medical staff, alongside the lack of resources, that spurred us into developing and carrying out a course in the essentials of neonatal care. After our training course we both went back to the UK for a few weeks.

On our return we were so pleased to find that a new set of twins had been born at 32 weeks' gestation and admitted to the paediatric ward. They had both been given the best level of care available to us currently: correct dosages of antibiotics and fluids, appropriate feeding support via NG tubes with EBM, and a well-informed and cooperative mother providing kangaroo mother care. Despite not having incubators, ventilators or even a dedicated neonatal unit, both twins are doing very well and gaining weight and will hopefully soon go home once they have established successful breastfeeding. This was all done in our absence by a dedicated and enthusiastic nursing and medical team.

Yirgalem

Our mother, enormously exhausted, arrived at Yirgalem hospital just two days after it had inaugurated its NICU . She didn't know that we were triplets. She gave birth to us all: two of us, weighing 1.7kg and 1.4kg, were born healthy and screaming, but our brother, though the biggest of us at 2.1kg, was not so well at birth, having difficulty breathing. Inspired nurses quickly transferred us all to the neonatal unit where they put us in a clean cot in a small hot room and our brother was immediately given oxygen. The nurses kept a close watch on our brother and, as they found that he was still having trouble breathing, scaled up him to bubble CPAP. Unfortunately, my other brother also developed breathing problems so also needed oxygen.

Fortunately, thanks to the NICU nurses, we all survived our first night, though two of us were struggling to breathe. By day two, none of us any longer needed breathing support. We were given EBM via NG tube, until we were big

enough to suck our mother's breast by ourselves.

Like the NICU nurses, our mother, staying next door, was given clean water from the running-water supply within the NICU, with which to wash her hands. This protected us against infection, which could have killed us since we run greater risk due to our small size to our age and hypothermia. Now we have a chance to grow into healthy children and lead long and happy lives.

Yirgalem

A primipara mother gave birth to a term but asphyxiated baby with severe respiratory distress. The baby was taken from the hospital delivery room by a midwife while the mother remained there for a further day to receive care for her emergency condition. Unfortunately, due to problems during her pregnancy and information she received about the baby's condition, the mother supposed that her baby was dead. However, the baby survived with the help of intense efforts by the NICU. The next day, when the baby was ready to try breast milk, a NICU nurse took the baby to his mother to breastfeed but she said 'no' because she believed that her baby was stillborn. After several hours' discussion that involved her relatives she was convinced to feed her baby. Later she was transferred to the NICU-KMC unit, where they stayed for one week, and once everything was stable they were discharged.

Dr Liz, Yirgalem

Baby Mamush was born at the local health centre to a mother with chorioamnionitis. After the first few hours of life when Mamush was found to be unable to suck breast and seemed to find it harder and harder to breathe, his parents brought him to Yirgalem hospital. There he was assessed and, being found to be in extremis, so was sent immediately to the paediatric ward to be resuscitated. There the nursing staff, who had recently completed the VSO training course in the essentials of newborn care, took baseline observations, inserted a cannula and sought out myself and Dr Toby. The baby's oxygen saturations were very low and he was clearly struggling to breathe and looked septic. Despite oxygen he did not improve and at one point stopped breathing and his heart rate slowed, both signs of imminent cardiac arrest.

With the support of our newly trained and confident nurses, the baby received CPR (cardiopulmonary resuscitation) and was stabilised enough with fluid and antibiotic boluses to be started on our new bubble CPAP (see above). Using our new oxygen saturation probes we saw the baby improve, with initial saturations of 33% coming up to 89% and then a satisfactory 93% alongside a reduced work of breathing. He received bubble CPAP for 12 hours before being weaned to simple oxygen and after 24 hours was off respiratory support and was breastfeeding well with his mother. He completed seven days of antibiotics before returning home with his family with no apparent long-term effects from his early illness.

Yirgalem

A multipara middle-aged mother delivered preterm and very low-birth-weight (each 900gm) triplets in the hospital, all with breathing difficulties and hypothermia. Two of the babies arrived in NICU breathless and the family insisted on going home, having given up hope for the newborns. However, after several hours' intensive resuscitation, the babies started to breathe. They received other intensive neonatal care for hypothermia and infection and after two weeks were well enough to be transferred to the KMC room for continuous monitoring and feeding for another two weeks before being discharged . These babies were so tiny that all the family members, including the father and cousins, were trained in the KMC method to assist the mother. Upon discharge the babies' body weight increased to 1.8kg, feeding on breast milk and active KMC.

Hossana

Preterm twins, each weighing 600gm, arrived to receive newborn care at NICU. A week later, one of the twins died and the mother and the rest of the family disappeared from the hospital, leaving the other child behind, perhaps having given up hope for him. After four weeks, in spite of his stable condition and having put on some weight (reaching 800gm), the surviving twin also expired. Although one cannot

be certain, he might have survived had the mother and family members been supportive in giving the care required by neonates such as breastfeeding and KMC. From this the unit learned of the need for counsellors or social workers to provide psychosocial support to mothers and caretakers of newborns so that they will collaborate with NICU nurses for better newborn care outcomes. Saving the lives of newborns is a function of multidisciplinary efforts involving mothers/caretakers, health professionals, social workers and others.

Arba Minch

One of the early success stories was a little girl, estimated to be 28 weeks' gestational age, weighing less than 1kg. She responded to homemade CPAP (Continuous Positive Airway Pressure), intravenous fluids, two courses of antibiotics, treatment for seizures and apnoea of prematurity. After lots of input she managed to come off oxygen and antibiotics. She started to grow with NG feeds of her mother's milk and was kept warm with KMC. We discharged when she was stable and fully breastfeeding. She returned a week later to be weighed: a healthy, happy 2kg baby! Her survival and the survival of all our admissions is testament to the success of this project and the dedicated team behind establishing this thriving neonatal unit. We envisage Arba Minch NICU becoming a centre of excellence in neonatal care and a sustainable and reproducible model for future units.

Arba Minch

Bamlake's mother is a laboratory technician who lives in Arba Minch and works for a local NGO about 30km away. Bamlak is her first child. Her mother started her monthly antenatal follow-up in the fourth month of her pregnancy, at the health centre where she worked. All her antenatal clinic (ANC) follow-up visits showed a normally progressing pregnancy until the seventh month, when she was told that her blood pressure was rising and might require a follow-up at Arba Minch hospital. On her first visit to Arba Minch ANC unit, her blood pressure was found to be too high, requiring immediate admission to stabilise the pressure. After two days in hospital, she was discharged, only to be readmitted two days later. This time not only her condition, but also the condition of the foetus, was deteriorating, demanding an urgent intervention. She was put under 'induced labor protocol' which ended up with assisted vaginal delivery after a prolonged labour. Their mother's life then had to be saved, for she was in a critical state with very high blood pressure, unstable vital signs and bleeding.

The floppy newborn baby showed no sign of life, did not cry and was not breathing. Reflexively, those who attended the delivery put the baby in a waste basket with no clothes to cover her and with no hope of seeing her alive. The family, waiting outside the delivery room, was told that the mother had had a stillbirth and that they were working hard to save her life. At this stage nobody was interested in seeing the newborn and they were all praying and crying for the mother.
After about 13 minutes of intense effort by those attending her, the mother's condition stabilised. At this point, one nurse remembered that the newborn was among the trash. Out of curiosity, the nurse went to her and observed signs of life. The nurse, just to see what could possibly be done, took her to NICU without even telling a family member, lest this create false hope.

At NICU, the baby was assessed and found to weigh close to 800gm and to be very cold (hypothermic), with very distant breathing and heartbeat and on the verge of death. She was resuscitated and put in the hot room while attempts were made to feed her. Unfortunately, due to her size, an NG tube was not available in the hospital, so the NICU nurse urged the father of the baby to search for one elsewhere. The family's reaction was mixed: almost no one but the father expected to see the baby alive. The father did his utmost to obtain a tube and other essential supplies, the baby gradually started shallowly breathing and her temperature started to normalise. No one dared to tell the mother about her newborn until on the second day the father told her that the baby was alive though under intensive care in the NICU. On the third day, the mother was transferred to the mother's room of NICU to see if she could breastfeed her baby. Her initial reaction was one of shock at seeing, holding

and being asked to feed her little one.. Drawing on the courage and strength of the father, she hesitantly accepted the request to hold and try to feed. “It was like a big earthworm. How could I accept such a thing as my child and care for it?” the mother reminisces.

After a prolonged and strenuous effort by the NICU staff, the father and then the mother, the baby’s vital signs stabilised and she started breastfeeding. After a month she weighed 1kg and after two months reached 1.7kg, when she was discharged.

“Look at her, she is smiling and playing with my breast … I am so happy, I have a baby girl,” said Bamlak’s mother on the day of discharge.

“These NICU nurses work day and night without even a tea break. They spend the whole night with us, went home and come back in the afternoon; I don’t know how they manage their private and social life. I have seen mothers who have been crying for their almost dead newborns leave the NICU smiling and blessing the NICU nurses. Additional nurses should come to work here so that the NICU can be strengthened. In fact, NICUs should be established in all health facilities including in health centres, such as the one where I work.” Bamlak’s mother after six month.

Arba Minch

My name is Lucky BB. I was conceived by a 13-year-old whose pregnancy so annoyed her stepmother that she left her with no help or medical care in the early stages of pregnancy. Despite this start, my life has been lucky so far. Let me tell you why.

My mother was very small, really only a young girl herself, so carrying me to full term would have meant a complicated delivery. I was probably small for gestational age, as my mother was malnourished. Like a lot of mothers, my mother did not know when her last period was, so I did not know how many weeks I had been in her womb when

I was born. Therefore I was running at least three life-threatening risks: prematurity, small for gestational age and preterm.

My mother went into labour prematurely and I was born by vaginal delivery weighing just 1.2kg. I was lucky to be born at Arba Minch hospital where, thanks to the generosity of UNICEF, VSO and Irish Aid, there is a neonatal intensive care unit. This meant I could receive the care a baby of very low birth weight and small for gestational age like me required, such as maintaining my body temperature. I was kept warm in the heated NICU room using locally made cost-effective radiant heaters, and well covered with colourful warm blankets which were knitted by residents of the care home where VSO Ethiopia volunteer Lindsey's mother lives in England.

My next problem was hypoglycaemia, low blood sugar. Because I was born before approximately 34 weeks' gestation I had difficulty suckling and so could not feed by myself. I was also very skinny, with very low body fat reserves to produce energy or food in the form of sugars in my blood. Therefore I was at risk of low blood sugar levels which can cause death. Luckily for me, Dr Jo Cryer, a neonatologist VSO Ethiopia volunteer, gave me sugar infusion, as a blood test had shown my blood sugar was too low. As I was too young to suckle, I was fed with EBM, the best and safest form of food for any baby via a syringe or NG tube, a tube passed via my nose into my stomach.

NICU nurses knew just the right amount to give me, as Dr Jo has developed a set of guidelines and protocols for the NICU so all this information is available for anyone working in the NICU, and all the nurses have been on a six-week training course under Dr Mulalem at The Black Lion hospital in Addis Ababa.

My next problem (as if I had not had enough already) was the risk of infection. Once again luckily for me, the NICU team knew just how to treat this and I was started on strong antibiotics. After 10 days I was gaining weight, managing with slowly increasing volumes of NG tube feeds and had developed no signs of infection, so the antibiotics were stopped.

Proper care of small and vulnerable babies requires regular and careful observation. Luckily for me, the NICU nurses at Arba Minch know they have to keep a close watch on their vulnerable babies and carry out regular observations of vital signs such as temperature, pulse, respiration and blood oxygen levels.

A few days later these observations showed I was starting to run a temperature, and once again I was put on a 10-day course of strong antibiotics. My temperature settled within 48 hours and I have had no raised temperature since.

As my weight increased with my two-hourly NG tube feeds and I grew stronger I could start to suckle. Being fed via an NG tube means you need do nothing for yourself, so it is easy to become lazy and let your nurses do everything for you, but once again they knew just what to do and started giving me part of my feeds via a baby bottle, making me learn how to suckle. This was not so bad, and gradually over several weeks the amount given via the bottle has increased and the amount given via the NG tube has decreased, so I can now suckle all the food I need from a bottle myself.

So you can see I have been very lucky because my birth was at Arba Minch hospital where the NICU is ready and waiting with the right equipment and trained caring nurses to manage small and vulnerable babies. Many more of us can survive to live a fruitful life if similar units with dedicated staffs are available that can provide careful observation of at-risk babies, like me, and can recognise and treat hypothermia, hypoglycaemia, hypoxia and neonatal sepsis, the four neonatal killers in Ethiopia.

I survived because I was handled by NICU which provides the basics of neonatal care services according to the WHO/Ethiopian Paediatric Society: resuscitation of newborns; prevention and treatment of infection; thermoregulation; fluid management; oxygen therapy; management of prematurity; treatment and recognition of jaundice; treatment and prevention of hypoglycaemia; and seizure management.

Appendix II: List of visited institutions and interviewed individuals

Dr Yirgalem Mekonnon	VSO Ethiopia, Programme Manager – Health
Dr Mulualem Gessesse	Consultant Neonatologist at Yekatit 12 Hospital
Dr Jo Cryer	VSO Ethiopia Paediatrician, Arba Minch Hospital
Dr Andrew Cornish	VSO Ethiopia Family Doctor, Arba Minch Hospital
Ato Solomon Tesfaye	NICU Head Nurse, Arba Minch Hospital
Ato Zenebe Bunchako	NICU Nurse, Arba Minch Hospital
S/r Frehiot Dagne	NICU Nurse, Arba Minch Hospital
Ato Hailu Shiberu	Head, Arba Minch Zonal Health Department
Dr Mitsiwa Ruffo	Paediatrician, Arba Minch Hospital
Dr Asfaw Jemaneh	Hospital Director, Arba Minch Hospital
Ato Delu H/mariam	Pharmacist, Arba Minch Hospital
Ato Tsegaye	MHIS Officer, Arba Minch Hospital
S/r Gete W/Giorgis	NICU Head Nurse, Nigist Elleni Memorial Hospital, Hossana
S/r Meaza Abatkun	NICU Nurse, Nigist Elleni Memorial Hospital, Hossana
Dr Meskerem Abatkun	General Practitioner, Nigist Elleni Memorial Hospital, Hossana
Ato Ermias Darebo	CEO, Nigist Elleni Memorial Hospital, Hossana
Ato Teshale Mebone	Officer, Hossna Zonal Health Department
Ato Negussie Yunkura	NICU Head Nurse, Yirgalem Hospital
S/r Helen Asefa	NICU Nurse, Yirgalem Hospital
Dr Rahel Tadesse	General Practitioner, Yirgalem Hospital
Dr Elizabeth Ledger	VSO Ethiopia Paediatrician, commented on draft report
Dr Toby Candler	VSO Ethiopia Paediatrician, commented on draft report

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