



The Federal Democratic Republic
of Ethiopia Ministry of Health

Road Map for Anesthesia Care in Ethiopia

2016/7-2020/1

Saving Lives through Safe Surgery



Federal Ministry of Health
Addis Ababa Ethiopia

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ABBREVIATION AND ACRONYM

BSC	Bachelor of Science Degree
CPD	Continuous Professional Development
CQI	Continuous Quality Improvement
CRC	Caring, Respectful and Compassionate
EAA	Ethiopian Association of Anesthetists
ESAPA	Ethiopian Society of Anesthesiology Professionals
FMHACA	Food, Medicine and Healthcare Administration and Control
FMOE	Federal Ministry of Education
FMOH	Federal Ministry of Health
HRH	Human Resources for Health
HEI	Higher Education Institution
HERQA	Higher Education Relevance and Quality Assurance Agency
HSDP	Health Sector Development Plan
MOU	Memorandum Of Understanding
MSc	Master of Science Degree
PG	Post Graduate (MSc and MD+)
PHD	Philosophical Degree
SaLTS	Saving Lives through Safe Surgery and Anesthesia
SDL	Skill Development Laboratory/ Lab
SOP	Scope of Practice
TBD	To Be Determined
WHO	World Health Organization

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FOREWORD

The Ethiopia Federal Ministry of Health has launched the Health Sector Transformation Plan (HSTP) as part of the second Growth and Transformation Plan of the Ethiopian government. The HSTP has set ambitious targets toward realizing the sustainable development goals and identified four transformation agendas: Quality and Equity, Woreda Transformation, Information Revolution and Compassionate, Respectful and Caring (CRC) health workforce.

In line with the quality and equity transformation agenda and as part of recognizing the key roles essential and emergency surgical care plays in achieving universal health coverage, the FMOH has prioritized surgical and anesthesia care by launching the national flagship initiative-Saving Lives through Safe Surgery (SaLTS).

As part of the national health care quality strategy which is an integral part of the HSTP, surgical and anesthesia care have been identified priority health conditions. To this effect, the Federal Ministry of Health has devised SaLTS. Saving Lives through Safe surgery (SaLTS) is the Federal MOH's flagship initiative that is designed to respond to the World Health Assembly (WHA) resolution of A68/15. The resolution is aimed at making Emergency and Essential Surgical and anesthesia care accessible and affordable, as part of the universal health coverage. The SaLTS initiative has been developed with the objective of ensuring the delivery of quality, safe, essential, and emergency surgery and anesthesia throughout the country to alleviate the national burden of diseases, disability and death which are preventable through safe surgery and safe anesthesia.

Anesthesia care and practice in Ethiopia has had a torturous history, starting from provision of care solely by expatriates till the early 1960's to the beginning of Diploma and BSc Nursing in the 1980's as well as the opening of 13 Level V anesthesia training programs and subsequent halt of 2/3 of the programs within a four-year period. Currently With the exception of 3 hospitals the anesthesia service in the country is entirely provided by BSc anesthetists and level V anesthetists. A critical shortage in HR is one of the many challenges anesthesia care is currently facing in Ethiopia, the issues stretch from equipment and supply provision, to safe patient centered care. In line with this, this road map was developed to strategically solve the issues identified under different thematic focus areas in a sustainable manner.

As a flagship initiative, SaLTS will receive the highest level of attention by the leadership of the health

sector. The development and moving forward, implementation of this road map is a testament to the ministry's firm commitment to improving surgical and anesthesia care throughout the nation, and accordingly concerned stake holders should act accordingly.



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EXECUTIVE SUMMARY

Ethiopia is the second-most populous Sub-Saharan Africa country with a population of 99.4 million, and a population growth rate of 2.5% in 2015¹. Despite major strides to improve the health of the population in the last one and half decades, Ethiopia's population still faces a high rate of morbidity and mortality, and the health status remains relatively poor compared to the developed world.

The Health Sector Development Programme concluded its 20 year run, which was divided into a series of four parts with five-year plans of HSDP I to HSDP IV. The policy was initially developed in 1997, and the last HSDP IV ended in June 2015. Health Sector Transformation Plan (HSTP)" is the next five-year national health sector strategic plan, which covers Ethiopian Fiscal Years, 2008-2012 (July 2015– June 2020). As part of the national health care quality strategy, which is an integral part of the HSTP, surgical and anesthesia care have been identified as priority health conditions. To this effect, the Federal Ministry of Health has devised SaLTS, or Saving Lives Through Surgery. The SaLTS initiative is designed to respond to the World Health Assembly resolution 68/15, which aims to make emergency and essential surgical and anesthesia care accessible and affordable, as part of the universal health coverage system.

In order to achieve this, it is mandatory to improve the quality of care and address the low number of health care providers, especially in anesthesia.

This road map is prepared to guide the effort in line with those objectives for the next 5 years as part of the SaLTS initiative.

Situational Analysis

Until the mid-1960s, anesthesia care in Ethiopia was provided by expatriates. The present School of Anesthesia opened in 1982 by the FMOH at the BLH. It trained nurses in an advanced diploma in anesthesia. It was later upgraded to training anesthetists with BSc degree. Gondar University is the pioneer in starting BSc level training in anesthesia. Later Jimma University and several others started training in anesthesia at BSc level. MSc training in anesthesia also started at Gondar University.

Physician training as specialists in anesthesiology started at the Department of Anesthesiology of Addis Ababa University in 1990. Currently, Jimma University and St. Paul's Millennium Medical College have started residency programmes in anesthesiology.

Since 2012, Level V anesthetist training has been going on at Regional Health Science Colleges. This is a one-year training in anesthesia for Diploma nurses. So far 380 Level V anesthetists have graduated from this educational system.

Currently in Ethiopia, training is provided in a total of 23 teaching institutions (4 Level V, 19 BSc, 02 MSc and 03 Residency programmes).

From the total of ~1050 actively practicing workforce, all 23 physicians and ~214 non-physicians are currently working as faculty in different tracks of trainings¹⁴. Referring to the standards set by HERQA & TVET for anesthesia education, this number of faculty with inadequate academic level mix is insufficient to run programmes. As a result of this severe faculty crisis, 9 of the 13 mid-level (Level V anesthetic nurses) anesthesia provider training sites/institutions have been closed in the past year.

Regarding service provision, out of the total of 23 anesthesiologists working in Ethiopia, 21 are working in Addis Ababa: 19 in Tikur Anbessa Hospital (Black Lion Hospital) and two in St

Paul's Hospital. The remaining 2 anesthesiologists are the only ones working outside Addis, both at Jimma University Specialized Hospital. That means for nearly all of Ethiopia except Addis, there is no anesthesiologist to provide high-level service or teaching. With the exception of 3 hospitals, the anesthesia service in the country is entirely provided by BSc anesthetists and Level V anesthetists.

In most hospitals, especially primary hospitals, there are at best two anesthesia practitioners and it is not uncommon to find only one anesthetist in the entire primary hospital.

A recent study conducted by Jhpiego to determine turnover intentions among anesthesia workforce revealed that almost half of (47.8%) anesthetists have planned to leave their job in the next year. Limited educational career development, uncomfortable conditions in the work place and being a Level V/ Diploma holder were the top significantly associated factors¹¹. Thus, targeted interventions need to be designed and implemented to promote retention and motivation among the anesthesia workforce.

Very few doctors choose to specialize in anesthesiology in spite of the great demand in the service sector. Studies done in this regard have shown this is mainly due to lack of awareness among medical students about this specialty.

Other studies have also shown a deficiency in critical skills among graduates practicing as anesthesia providers. Interviews with both anesthetists and surgical care providers have also highlighted the prevailing tendency that the role of the anesthetist is limited to the operating theatre. In most places, they have little or no role in the pre-and post-operative care. Lack of a system for reporting adverse events, lack of a regular clinical audit, inconsistent use of checklist and lack of standard operating procedures are also factors that negatively impact the quality of care in general.

The pharmaceutical and equipment supply for anesthesia care is not always satisfactory. Continuous shortage and sometimes total absence of basic/ essential drugs, consumables and equipment in most of the government hospitals throughout the country is not unusual.

Regular maintenance as well as proper day-to-day care of equipment is not available. Lack of maintenance and minor repairs has resulted in a high number of nonfunctional equipment.

With this background, the road map was prepared to guide the efforts to ensure safe delivery of essential and emergency surgical and anesthesia service in the country.

The road map is targeted to achieve the following aims:

I. Improve Leadership in Anesthesia Care

II. Increase the anesthesia workforce as well as solve the acute crisis in quality of the anesthesia workforce

III. Improve and maintain quality and safety of anesthesia care

IV. Ensure the availability, in adequate amounts and in a sustainable manner, of anesthesia pharmaceuticals, equipment and utility supplies

Methodology

This 5-year National Anesthesia Road Map was developed by a technical working group chaired by a delegate from FMOH. TWG consisted of seven members made up of representatives of local professional associations, SaLTS implementing partners and technical advisors from the Ministry.

The major strategies of the Road Map were arranged or categorized under 3 pillars. The themes/pillars are:

- Human Resources
- Quality
- Pharmaceuticals and Equipment

Targeted interventions are then arranged under each pillar as focus areas.

Pillar 1: Human Resource

1. Leadership

The interventions under this focus area are to ensure representation of anesthesia workforce in all structures of SaLTS, to conduct advocacy and promotional activities to raise the profile of the profession, and to establish a National Anesthesia Council.

2. Increase workforce availability in anesthesia

The use of promotion including during undergraduate medical education, creating favorable admission policies for anesthesia training, use of cognitive apprenticeship, opening new anesthesia training sites and training abroad are discussed as the intervention under this focus area.

3. Strengthen anesthesia training institutions

Reopening closed institutions, using retirees and collaboration among institutes to solve the shortage of faculty, use of simulation based training, public private partnership, trainings in clinical teaching methods and simulation based teaching for faculty are proposed.

3. Improve motivation and retention

Developing a clear career structure, an electronic graduate tracking mechanism, incentive schemes, creating a conducive work environment, and reducing job stress are put forward.

4. Solve the acute workforce crisis

Surgical campaigns and mentoring visits are proposed.

Pillar II: Quality of Care

Under this pillar, improving the quality of anesthesia education and anesthesia care delivery are the two focus areas.

Regarding the quality of education, implementing the HERQA standard and ways of improving the efficiency of the training are proposed.

The suggested interventions to improve quality of anesthesia care include: use of need based CPD courses, the use of skill development labs and utilizing service guidelines, standards and protocols. The development of quality indicators and generation of data are also considered very important activities in improving quality of care.

Pillar 3: Pharmaceuticals and Equipment

Reviewing and updating the National List of Anesthetics and Equipment as well as creating a forum for disseminating the information should be created. More efficient supply chain management is highly imperative. Reviewing guidelines for equipment maintenance and repair, and the training of bio medical technicians is also proposed under this pillar.

BACKGROUND AND CONTEXT

Health care provision in Ethiopia is predominately public. Health care delivery in Ethiopia is conducted through a network of health facilities arranged in three tiers. Level one is a primary health care unit (PHCU) comprised of a primary hospital (to cover 60,000-100,000 people), health centers (1/15,000-25,000 population) and their satellite Health Posts (1/3,000-5,000 population), connected to each other by a referral system. The primary hospital, health centre and health posts form a Primary Health Care Unit (PHCU). Level two is a General Hospital covering a population of 1-1.5 million people, and level three is a Specialized Hospital covering a population of 3.5-5 million people.

Despite major strides to improve the health of the population in the last one and half decades, Ethiopia's population still faces a high rate of morbidity and mortality and the health status remains relatively poor compared to the developed world. To tackle these problems, the government has devised the National Health Sector Development Programme as part of the growth and transformation plan. The Health Sector Development Programme concluded its 20 year plan, which was divided into series of four parts with five-year plans of HSDP I to HSDP IV. The policy was initially developed in 1997 and the last HSDP IV ended in June 2015. Health Sector Transformation Plan (HSTP) is the next five-year national health sector strategic plan, which covers Ethiopian Fiscal Years 2008-2012 (July 2015– June 2020). HSTP is guided by a road map prepared jointly with all relevant stakeholders under the leadership of the Ministry of Health and Regional Health Bureaus.²

As part of the national health care quality strategy, which is an integral part of the HSTP, surgical and anesthesia care have been identified as priority health conditions. To this effect, the Federal Ministry of Health has devised SaLTS. Saving Lives through Safe Surgery (SaLTS) is the Federal MOH's flagship initiative that is designed to respond to World Health Assembly (WHA) Resolution A68/15. The resolution is aimed at making emergency and essential surgical and anesthesia care accessible and affordable, as part of the universal health coverage system.³ The SaLTS initiative has been developed with the objective of ensuring the delivery of quality, safe, essential, and emergency surgery and anesthesia throughout the country to alleviate the national burden of diseases, disability and death, which are preventable through safe surgery and safe anesthesia.⁴

Ethiopia has made commendable progress in improving the health status of its citizens as measured by prolonged life expectancy at birth and improvements in mortality rates of children and mothers. In addition, Ethiopia has seen a decline in mortality and incidence due to major communicable diseases. Nonetheless, Ethiopia is still burdened with low health worker density and inequitable distribution among health care providers. Anesthesia providers are among the fewest available in the country with a total number of 23 Anesthesiologists and 875 different level anesthetists for the population of 99.4 million⁵. Compare this to the Lancet Commission's recommendation of 8 anesthesia practitioners per 100,000 people.

At present in Ethiopia, the categories of anesthesia practitioners are as follows:

1. Anesthesiologists (MD + specialty training)
2. MSc Anesthetists (Anesthetists with 2 years post-graduate training)
3. BSc Anesthetists (Bachelor's degree after 4 years of training)
4. Level V anesthetists (Diploma nurses with 1-year training in anesthesia)

The total number of anesthesia providers practicing now in Ethiopia is ~1050 of which only 23 are anesthesiologists.

The SaLTS initiative of the MoH is launched with the aim of making quality essential and emergency surgery accessible to the people of Ethiopia. In order to achieve this, it is mandatory to improve the quality of anesthesia care and increase the number of anesthesia practitioners to provide the unmet needs.

This road map is prepared to guide the effort in line with those objectives for the next 5 years. The Strategic Road Map will also provide policy makers, managers, and employees the guidance required to contribute their specific roles for the successful accomplishment of the Global Safe Surgery 2020 goal.

SITUATIONAL ANALYSIS

Until 1963, anesthesia service in Ethiopia was provided entirely by expatriates. One of these expatriates, Dr. Gosse, an Indian anesthesiologist, trained 7 local nurses for 6 months in anesthesia. In 1974, a formal training in anesthesia was opened at the Black Lion Hospital (BLH) by the MoH and WHO. 18 nurses trained at The School of Anesthesia graduated as anesthetists. The school was closed when the WHO staff left the country.

The present School of Anesthesia opened in 1982 by the MoH at the BLH. It trains nurses for an advanced diploma in anesthesia.

Gondar University is a pioneer in starting BSc training in anesthesia. Following that, the Addis Ababa School of Anesthesia upgraded its training to BSc level. Jimma and later several other universities also started generic BSc training in anesthesia. The MSc level training for holders of the BSc in anesthesia also started at Gondar University.

Physician training as specialists in anesthesiology was started at the Department of Anesthesiology of Addis Ababa University. The department was opened in 1990 by the Australian Anesthesiologist Dr. Keith Streatfield. Later, Dr. Burmeister-Rother, an Austrian anesthesiologist, joined the department. The department to date has graduated 34 anesthesiologists. Currently, Jimma University and St. Paul's Hospital and Millennium Medical College have new residency programmes in anesthesiology.

Since 2012, Level V anesthetist training has been going on at Regional Health Science Colleges. This is a one-year training in anesthesia for Diploma nurses. So far, 380 Level V anesthetists have graduated from this educational system.

The government of Ethiopia has exerted tremendous effort to expand non-physician anesthesia workforce teaching institutions from 3 in 2010 to more than 30 by the year 2015. The number of graduates has also increased from 56 to more than 200. However, such expansions are not observed in the training of the other anesthesia workforce- anesthesiologists.

Currently in Ethiopia, training is provided in a total of 23 teaching institutions (4 Level V, 19 BSc, 02 MSc and 03 Residency programmes).

Table: Current and Expected Enrollment in Anesthesia Training

Programme	No. of expected graduates				
	2017	2018	2019	2020	Total
Anesthesiology Specialty (MD+)	3	8	6	TBD	17
MSc in Anesthesia	25	31	31	31	118
BSc in Anesthesia	298	353	392	396	1439
Level 5 Anesthetic Nurse	80	TBD	TBD	TBD	80
Total	406	392	429	427	1654

From the total of ~1050 actively practicing workforce, all the 23 physicians and ~214 non-physicians are currently working as faculty in different tracks of trainings¹⁴. Referring to the standards set by HERQA and TVET for anesthesia education, this number of faculty with inadequate academic level mix is insufficient to run programmes.^{15,16} As a result of this severe faculty crisis, 9 of the 13 mid-level (Level V anesthetic nurses) anesthesia providers training sites/ institutions have been closed in the past year. Efforts have been made to overcome faculty shortage through involvement of volunteer/visiting foreign tutors in the trainings, though this has not helped much due to lack of sustainability.

Based on the Ministry's 10-year HR (Human Resource) projection, Ethiopia will need an additional 2710 anesthesia workforce (85 physician and 2625 non-physicians) by 2020, and 6318 (160 physicians and 5260 non-physician anesthetists) by the end of 2025.¹⁷ This number is projected by taking the newly opening Primary Hospitals into consideration.

A recent study conducted by Jhpiego to determine turnover intentions among anesthesia workforce revealed that almost half of (47.8%) anesthetists have planned to leave their job in the next year. Limited educational career development, uncomfortable conditions in the work place and being a Level V/ Diploma holder were the top significantly associated factors¹¹. This problem is much worse in the physicians group. One unpublished report revealed that 32.3% of this workforce migrated to foreign countries in the past couple of years¹². Thus, targeted interventions need to be designed and implemented to promote retention and motivation among the anesthesia workforce.

Regarding service provision, out of the total of 23 anesthesiologists working in Ethiopia, 21 are working in Addis Ababa: 19 in Tikur Anbessa Hospital (Black Lion Hospital) and two in St Paul's Hospital. The remaining 2 anesthesiologists are the only ones working outside Addis, both

at Jimma University Specialized Hospital. That means for nearly all of Ethiopia except Addis, there is no anesthesiologist to provide high-level service or teaching. With the exception of 3 hospitals, the anesthesia service in the country is entirely provided by BSc anesthetists and Level V anesthetists.

In most hospitals, especially primary hospitals, there are at best two anesthesia practitioners, and it is not uncommon to find only one anesthetist in the entire primary hospital.

Very few doctors choose to specialize in anesthesiology in spite of the great demand in the service sector. This is mainly due to lack of awareness among medical students about this specialty. In one study done in Ethiopia in 2014, only 10% of medical students in Ethiopia had awareness or knowledge about what anesthesiology is as a specialty and what anesthesiologists actually do in healthcare. Amazingly, only 2% understand the role of the anesthesiologist in medical practice. From the study, we can also infer that the awareness of the general population to be way below this. This has a great impact in choosing anesthesiology as a future career among medical students and the youth in the general population. In another study done in 2011 on the influence of undergraduate education on the choice of anesthesiology by medical students, 60% of the students chose anesthesiology as their least preferred choice for their future career. The determining factor for this was the low degree of exposure during their undergraduate study.

A recently published cross sectional study conducted by Jhpiego in April 2016 to determine competence of graduate non-physician anesthesia providers reported that graduates' performance varied with mean percentage scores: spinal anesthesia (80%), neonatal resuscitation (74%), endotracheal intubation (73%), and LMA insertion (71%). Average scores were lowest for routine anesthesia machine check (37%) and preoperative screening (48%)²⁵. Another unpublished study on task analysis of anesthetists identified 9 highly critical tasks where more than one quarter of graduates were not adequately trained before deployment²⁶. These tasks include: infection prevention, resuscitation of critically ill patients, equipment handling, and promoting a safe work environment. Thus, adequate emphasis must be provided for pre-service education strengthening and in-service training for tasks which the workforce itself identified as being unable to perform, or not adequately learned during pre-service education.

Interviews with both anesthetists and surgical care providers have also highlighted the prevailing tendency that the role of the anesthetist is limited to the operating theatre. In most places, they have little or no role in the pre and post-operative care. Lack of a system for reporting adverse events, lack of a regular clinical audit, inconsistent use of checklists and lack of standard operating procedures are also factors that negatively impact the quality of care in general.

It is important to set practice boundaries for the existing different anesthesia workforces,

thereby promoting professional integrity and ultimately protecting the public from health risks associated with practices beyond the allowable scope. Considering this, FMHACA has developed Scope of Practice to regulate the practice of health professionals, including different level anesthesia providers. This SOP document was developed on the basis of training curriculum, graduate profile of cadres, occupational standards for TVET and training programme and other relevant best practices. This is expected to improve the quality and utilization of anesthetic services. Until this time, a total of 875³⁷ anesthesia (all categories) workforce is licensed and registered under FMHACA²⁴

Interviews with practicing anesthetists have revealed that recent misunderstandings about medico legal issues have been demotivating factors in delivering compassionate and safe care. Defining scope of practice and clear guidelines regarding legal accountability in practice are important to address this point.

As a means to improve quality of education and ensure public safety, FMOH has established a national pre-deployment licensure examination for health professionals including Bachelor anesthetists through knowledge-based assessment. This examination was provided for two consecutive years where 89.6% of the total graduates in 2016 have passed the knowledge-based examination successfully with overall mean score of 65%²⁷. TVET agency has been providing knowledge and skill-based assessments to Level V graduates for similar purposes. Thus, such pre-deployment examinations need to be strengthened to include skill-based assessment and assure the quality of education together with public safety.

In-service trainings for professional development must be identified, designed and provided for the anesthesia workforce regularly. National statistics reports on this area are not well recorded and found. However, unpublished reports from professional associations indicated that some physicians and 450 non-physician anesthesia providers have obtained different need-based technical update trainings in the past four years^{28, 29}. However, further impact evaluations after these trainings were not obtained and/or performed. Per the national In Service Training Guideline (IST), a total of 9 need-based IST packages were developed, approved by FMHACA and prepared for delivery to the anesthesia workforce³⁰. Given the critical nature of the profession and the limited opportunities for such technical update trainings, training interventions must be designed and provided regularly.

Evidence-based and up-to-date clinical guidelines should be used to make recommendations on appropriate anesthetic management and care of patients undergoing surgery and/or resuscitation. Development, adoption and utilization of standardized clinical anesthesia practice guidelines will reduce current variations in practice, ensure efficient use of resources, and strengthen clinical teaching of anesthesia students. Considering this, 19 different clinical anesthesia practice guidelines were developed, printed and distributed to 100 hospitals used as

clinical training sites for anesthesia students³¹. However, standardized quality improvement tools and follow-up mechanisms for practicing anesthesia workforce are not well established.

The pharmaceutical and equipment supply for anesthesia care is not always satisfactory. Quality anesthesia care relies on the availability of safe, effective and affordable medicines with the required quality, in reasonable amounts.³² Most of the basic minimum required anesthetic and ancillary drugs are incorporated into the National List of Medicines for Ethiopia as developed by FMHACA. Moreover, a National Medical Equipment List has incorporated specifications for most of the equipment and materials required for the provision of anesthetic care.³³ Both of these documents were developed a couple of years ago, while no data is obtained on revision and updating matters. Although most of the essential and standard anesthesia drugs and equipment are listed on national documents, there is continuous shortage and sometimes a total absence of basic/essential drugs, consumables and equipment in most of the government hospitals throughout the country. This is highly compromising the anesthesia education as well as the anesthesia service.³⁴ A more efficient supply chain management should be in place.

Regular maintenance as well as proper day-to-day care of equipment is not available. Lack of minor repair has resulted in much of the equipment being nonfunctional. It is common to find nonfunctioning anesthesia machines, suction machines, monitors, etc. in hospitals. It is imperative to include in the workforce personnel with training in doing common maintenance and repair.

STRATEGIC OBJECTIVES

The main objective of this 5-year Road Map is to develop and maintain sufficient numbers of a skilled anesthesia workforce with a balanced mix of professionals with an anesthesia team approach in order to provide all Ethiopians with access to quality and safe essential and emergency surgical and anesthesia care. At the same time, it will address the uneven distribution of professionals and ensure adequate supplies to provide quality anesthesia services. Hence the road map is targeted to:

- I. Improve leadership in anesthesia care
- II. Increase the anesthesia workforce as well as solve the acute crisis in quality of anesthesia workforce
- III. Improve and maintain quality and safety of anesthesia care

IV. Ensure the availability, in adequate amounts and in a sustainable manner, of anesthesia pharmaceuticals, equipment and utility supplies

METHODOLOGY

This 5-year National Anesthesia Road Map was a collaborative effort of different organizations and individuals including a technical working group . The *Anesthesia care roadmap TWG* consisted of seven members that were representatives of local professional associations, SaLTS implementing partners and technical advisors from the Ministry. National and international relevant documents were gathered, reviewed and incorporated as appropriate. These documents include but are not limited to: government legislations and policies, reports and studies conducted in anesthesia practice and education by different partners, records from professional associations (ESAPA and EAA), and different WHO and other international professional association publications and reports. Moreover, the development of this document employed interviews and experience shares from national and international experts with relevant experience in the area. This document was later presented to a summit made up of a national and international panel of experts for critical review, modification and edition. Through integration of comments obtained from the summit, the final version of the document was finalized by the technical working group and a core development team. The SaLTS technical working group reviewed and approved the final document.

National anesthesia care areas addressed under this road map are thematically categorized into three pillars. These pillars were used to identify the major strategies of the Road Map. The themes/pillars are:

- Human Resource
- Quality
- Pharmaceuticals and Equipment

Targeted interventions are then arranged under each pillar as focus areas.

The conceptual framework shown below presents the relationship among proposed pillars/focus areas and quality anesthesia education and service that leads to provision of safe surgical and anesthesia care.

PILLARS, FOCUS AREAS AND INTERVENTIONS

An outline of the Pillars and Focus areas for intervention are summarized below:

Pillar 1: Human Resource

Focus Area 1.A: Improve leadership in anesthesia

Focus Area 1.B: Increase workforce availability in anesthesia

Intervention 1.B.1: Increase enrollment in anesthesia training

Intervention 1.B.2: Strengthen anesthesia training institutions

Intervention 1.B.3: Improve motivation and retention

Intervention 1.B.4: Solve the acute workforce crisis

Pillar 2: Quality of Care

Focus Area 2.A: Improve quality of anesthesia education

Intervention 2.A.1: Support institutions to conduct self-assessment using HERQA standards

Intervention 2.A.2: Improve efficiency in anesthesia education

Focus Area 2.B: Improve and maintain quality of anesthesia care

Intervention 2.B.1: Design and provide need-based, standardized Continuous Professional Development (CPD) courses¹ for anesthesia providers²

Intervention 2.B.2: Establish national state-of-the-art skill development labs in identified regions

Intervention 2.B.3: Develop and utilize service guidelines, standards and protocols

Intervention 2.B.4: Improve working environment for anesthesia care providers

Intervention 2.B.5: Develop and utilize quality indicators for perioperative care

Intervention 2.B.6: Promote generation of data for evidence based practice

Intervention 2.B.7: Implement CRC in all aspects of anesthesia practice

Intervention 2.B.8: Strengthen National Licensure Examination

Pillar 3: Pharmaceuticals and Equipment

Focus Area 3.A: Ensure availability of anesthetic pharmaceuticals and equipment

Intervention 3.A.1: Review and regularly update National List of Anesthetic Pharmaceuticals and Equipment

Intervention 3.A.2: Create a more efficient supply chain management for anesthesia pharmaceuticals and equipment

Intervention 3.A.3: Revise minimum acceptable specifications for anesthesia machine, monitoring devices and other related equipment

¹ This shall include Obstetrics management and effective team working

² This includes coaching and mentoring by senior anesthesia providers

Intervention 3.A.4: Create a forum for the dissemination of updated list and specifications³

Intervention 3.A.5: Review and revise guidelines for maintenance of anesthesia equipment

Strategic Interventions

Pillar 1: Human Resource

Focus Area 1.A: Improve leadership in anesthesia

Regarding leadership in anesthesia, the following interventions are suggested:

1. Ensure proper representation of anesthesia workforce representatives at all levels of SaLTs structure (executive, project, technical, facility, and OR teams).
2. Develop anesthesia care plan at all levels. A working manual to ensure existence of unified leadership in anesthesia unit/department at all facilities should be developed.
3. Establish common platform for anesthesia care (National Anesthesia Council/ Assembly).
4. Conduct advocacy and improve communication (e.g. strategic use of the mass media, radio, TV media advocacy, electronic media, brochures, etc). Conduct promotional activities to raise the profile of the anesthesia profession in the community, schools, government offices and other stakeholders.
5. Establish clinical governance at the facility level as well as regular clinical audits.

Focus Area 1.B: Increase workforce availability in anesthesia

1. Increase enrollment in anesthesia training

Make an effort to attract informed, devoted and prospective applicants into the field.

Target admission policies to address the socioeconomic, ethnic and geographical diversity of applicants. Enrollment can be encouraged through the following activities:

- Develop key promotional messages on workforce relevance and prospects.
- Organize promotional activities to the community, to high school students and medical and other health care students in anesthesia training universities.
- Use of the internet & web site/page.

³ In addition to anesthesia providers, RHB representatives and Hospital managers are encouraged to attend this

- Incorporate a 3-week attachment in anesthesiology within the undergraduate curriculum in all medical schools.
- Create favorable conditions for applicants to anesthesiology training. This will include incentives like allowing postgraduate admission without service year requirements, reducing the service commitment after postgraduate training, allowing “self-sponsors” to join residency, facility level financial compensation for work done as a trainee, etc.
- Train some residents abroad until a critical level is reached both for training and service provision.
- Introduce cognitive apprenticeship in anesthesia training.

In an apprenticeship, students function as healthcare providers while the clinical instructor or assigned staff member closely observes and intervenes when appropriate⁴⁵. Increased number of students can be enrolled into programmes where the theoretical sessions will be provided in blocked fashion and students will be sent to apprenticeships to practice clinical anesthesia skills under direct supervision of hospital-practicing anesthesia providers. Assignment placements can be anywhere as long as the clinical site fulfills the requirements for the desired attachment. In this regard activities to be conducted are:

Work with institutions to identify appropriate sites for apprenticeship.

Work with institutions and clinical practice sites to sign MOU.

Equip clinical practice sites with required adequate training aids.

Allocate incentives for clinical coaches.

Integrate the cognitive apprenticeship programme into the curriculum.

Allocate adequate budget for students.

- Open new anesthesia training sites (see annex).

2. Strengthen Anesthesia Training Institutions

- Support closed anesthesia training institutions to reopen.

Several regional health colleges training Level V anesthetists have ceased training. The current condition of these facilities should be evaluated and the necessary support

³⁶ Effective teaching : A Guide for Educating Health Care Providers. Reference Manual. WHO and Jhpiego. 2003

provided to restart training. The support would include training aids, tutors, providing adequate classroom space and supporting student services.

- Support Level V training institutions to increase enrollment to 15 to 20 per batch.
- Promote for restructuring Level V training colleges to be under respective Regional Health Bureaus.
- Strengthen collaboration to solve faculty crisis. This will include pooling faculty from local institutions, international organizations, and professional societies.
- Involve retirees in training as tutors/instructors.
- Establish linkages with universities abroad.

In an effort to build the academic programme during this 5-year foundation (transitional) building period, visiting, short-term academic educators with experience teaching in the African context would come to universities with anesthesiology residencies on a rotating basis from abroad and thereby form a consistent, on-the-ground presence for longer periods (12 months), give lectures and provide daily clinical teaching for the trainees.

- Strengthen simulation-based teaching.

Simulation centers are a training requirement and widely used in pre-service training and continuous professional development. Strengthening the existing simulation centers in anesthesia teaching institutions is one of the mechanisms to increase enrollment into anesthesia programmes. These simulation centers can also be used in certain types of research, often with the objective of improving patient safety. To strengthen simulation centers, the following activities shall be conducted:

Identify list of competencies to be taught in simulation centers.

Determine list of skill lab equipment required to teach each competency area.

Develop and utilize tools to be utilized for teaching and assessing achievement of competencies.

Provide required skill lab material and equipment in anesthesia training institutions.

Provide clinical simulation training for anesthesia faculty involved in simulation-based training.

Establish a mechanism to monitor functionality of equipment and regular maintenance.

- Design and provide short-term trainings in clinical teaching methods and simulation-based teaching to anesthesia faculty.
- Establish a system for public private partnership for anesthesia training.
- Support training institutions to upgrade their training to the next level.

The better Level V training institutions may be supported to upgrade training to BSc level. Subspecialty training in pediatric and obstetric anesthesia, neuro-anesthesia, cardiothoracic anesthesia and obstetric anesthesia should be considered in institutions where such surgeries are routinely done.

3. Improve Motivation and Retention

Motivation and retention strategies are critical in improving the availability and performance of the health workforce. Attrition among anesthesia providers is quite significant. The following interventions are directed at improving motivation and increasing retention:

- Develop a clear career structure for the anesthesia workforce.
- Conduct regular motivation and retention studies as well as analysis of attrition rates.
- Establish electronic graduate tracking mechanism.

This will provide accurate and up-to-date data on the number, profile, and geographic distribution of the workforce.

- Revise incentive scheme for anesthesia providers. These include hazard allowances, duty pay, living allowances, transport and telephone allowance, etc. This can be done at the facility level.
- Salary top ups for those working at rural or remote areas as well as for those serving in the public sector for long periods.
- Recognize best-performing/champion anesthetists.
- Provide short-term refreshment trainings and research grants.

- Create a conducive work environment such as good infrastructure, adequate supplies, free of harassment.
- Reduce job stress with better collaboration among surgical team members. For example, a common pre-op conference with the other surgical workforce, presence of assistants such as OR technicians, etc.

4. Solve the Acute Workforce Crisis

- Conduct regular surgical campaigns in underserved areas.
- Conduct short-term coaching and mentoring visits to underserved areas through cluster lead hospitals and professional associations.
- Encourage and incentivize senior workforce members to support primary hospitals.

Pillar II: Quality of Care

Quality is an important issue in health care delivery. It is also a major contributor to safety. Attempts to upscale service or increase the workforce may compromise quality unless serious consideration is given to maintain and improve quality and relevance. Efforts to improve quality naturally should address the quality of training and competence of graduates as well as the service environment, which has an impact on the type of care being delivered. Accordingly, the focus areas in quality are: improving quality of anesthesia education and improving quality of anesthesia care. Some of the activities in this section overlap with the activities mentioned in the preceding section under *Increasing Enrollment in Anesthesia* “.

Focus Area 1.A: Improve Quality of Anesthesia Education

1. Support Institutions to Conduct Self-Assessment Using HERQA Standards

- Encourage anesthesia HEI to conduct quality audits using HERQA standards as well as critically evaluate the relevance of each programme.
- Support peer review. Organize geographical clustering of anesthesia teaching institutions to facilitate experience sharing. This forum will also provide the opportunity to recognize best performing training institutions.

- Conduct task analysis study on anesthesia graduates. This will lead to updating the core competencies of the anesthesia workforce and the integration of non-technical skill (NTS) competencies in the training.

2. Improve Efficiency in Anesthesia Education

- Create strong interaction and interdependence between teaching units and clinical work.
- Introduce the use of advanced teaching methodologies and platform to anesthesia education.

This includes problem based learning, computer assisted, workplace and e-learning environments, and telemedicine.

- Introduce a National Library of Anesthesia Lectures to be used by all educators and trainees in an intranet system.

A collection of anesthesia lectures has been developed by one of the Safe Surgery 2020 partners, which is being used in East Africa in an effort to provide lectures for educators of anesthesia care providers. Adaptation of the same could be implemented. This will provide a national standard for anesthesia education in preparation for the national licensure exam.

- Strengthen teaching methodology training to faculty.

Teaching methodology training should be provided to all trainers. Emphasis should be given to clinical teaching and simulation-based teaching.

Focus Area 1.B: Improve and Maintain Quality of Anesthesia Care

1. Design and Provide Need-Based, Standardized Continuous Professional

Development (CPD) courses for anesthesia providers:

- World Federation of Society of Anesthesiology (WFSA) Safe Obstetrics and Safe

Operating Room Management short courses. Train the trainer model training clusters can be used to cover providers throughout Ethiopia.

- Obstetrical Emergency Team Training. A mobile obstetrical team training model has been developed in East Africa to train the whole team. This 2-day course has dramatically improved communication, feedback and team work. This will translate to improved outcomes.
- Other courses covering areas of high criticality and/or less frequency may be included based on task analysis.

2. Establish National State-of-the-Art Skill-Development Labs in Identified Regions

- Establish 4 such labs in Oromia, Amhara, Tigray and SNNPR.
- A core group of educators in each region should receive 3 to 6 months of training in simulation development, delivery, and simulation centre management.
- Other health cadres could also use the centers for CME credits.

3. Develop and Utilize Service Guidelines, Standards and Protocols

- Identify practice areas in anesthesia care for a national standard and protocol development.
- Nationally adopt the service standards and protocols.
- Ensure implementation of standards of practice including checklists.

4. Improve Working Environment for Anesthesia Care Providers

This will decrease stress as well as improve efficiency. The following measures could be implemented:

- Assign anesthesia assistants in the OR to prepare equipment and supplies, clean and sterilize equipment properly, and assist with preparation of patients.
- The permanent assignment of “OR technicians” who have training in doing low level maintenance and troubleshooting in cases of equipment failure or malfunction.
- Increase the number and quality of post anesthesia care provider nurses by providing proper training.
- Set up a pre-anesthetic patient evaluation clinic in hospitals.
- Include anesthesia care providers in the drug information centre at each hospital.
- Reduce environmental health hazard in the OR. This will include ensuring free hepatitis vaccination, regular monitoring of air quality and noise level in

the OR, and proper radiation protection during procedures involving radiation.

- Adequate information about the relevant laws and regulations of the country governing the practice of surgery and anesthesia.
- Proper protection and coverage against medico legal claims by the employing institution.

5. Develop and Utilize Quality Indicators for Perioperative Care

- Introduce or revise quality improvement tools specific to anesthesia care.
- Selected outcome indicators of anesthesia care (perioperative mortality rate, intra operative death, intra operative cardiac arrest and respiratory arrest, need for reintubation, wrong side surgery etc.) should be in the SaLTS KPI's.
- Process indicators such as operation time tardiness (start time for first case), cancellation rate, documentation compliance, percentage with pre-op evaluations, etc., should be monitored at each facility.
- Regular clinical audits with review of the indicators should be done at facility level.

6. Promote Generation of Data for Evidence-Based Practice

- National baseline assessment of all regional, referral, and academic facilities regarding anesthesia and critical care.
- Establish a national electronic data system equipped with the required resources for the reporting of anesthesia related to morbidity and mortality. Training should be given in the proper implementation of the system.

7. Implement CRC in all Aspects of Anesthesia Practice

- Integrate CRC competencies during revision of different workforce curricula.
- Promote ownership of CRC agenda among anesthesia workforce using professional societies.
- Provide trainings on CRC implementation to practicing workforce.

8. Strengthen National Licensure Examination

- With expansion of training centers, the need for a uniform standard and at the same time ensuring the protection of the public will require a national licensing exam. Training qualified exam developers to develop exams that assess both knowledge and skill should be initiated.
- Establish one Board of Anesthesia to monitor enrollment and licensing of post-graduate anesthesia trainees of all categories. This can be achieved via collaboration of the existing professional associations with the FMOH.

Pillar 3: Pharmaceuticals and Equipment

Anesthesia enables a patient to tolerate surgical procedures that would otherwise inflict unbearable pain.

In order to properly manage anesthesia for all types of patients by selecting the optimal anesthetic technique, it is mandatory to have basic and essential pharmaceuticals and equipment per hospital level. The presence of efficient supply chain management is mandatory. At present, many institutions find the process for obtaining required resources lengthy and inefficient. In this regard, the following activities are recommended to be conducted:

1. Review and Regularly Update National List of Anesthetic Pharmaceuticals and Equipment

- Revise national equipment and drug list for anesthesia to incorporate minimum required equipment (per WHO recommendation) and the National Drug List.
- Perform quick survey on availability of essential drugs at hospital level.
- Strengthen the existing system to communicate with PFSA to update list on out-of-stock drugs.
- Perform need assessment on drugs/ equipment and supplies.
- Include new drugs and equipment in the National List based on the need assessment.
- During purchase of anesthesia machines, monitors and accessories, the following recommendations shall be considered:
 - a. Team of appropriate anesthesia workforce and biomedical engineers need to be involved.
 - b. The reputation of the suppliers and quality of the supplies need to be checked.
 - c. All the equipment should be purchased from one supplier.
 - d. There should also be an agreement for continuous supply of accessories and for provision of maintenance service.

- e. When necessary, the supplier should provide training on the proper use of the equipment.
2. Create a More Efficient Supply Chain Management for Anesthesia Pharmaceuticals and Equipment
 - Establish online forum among professionals and PFSA to have up-to-date information on national anesthetic stock levels.
 - Include anesthesia professionals in the Drug and Therapeutic Committee at hospital level.
 - Encourage private companies to be involved in importing anesthesia drugs and equipment.
 - Establish equipment maintenance centres at federal and regional level.
 - Train anesthesia professionals' user-level training on maintenance of anesthesia equipment.
 - Develop a standard audit tool and monitoring for pharmaceuticals and equipment throughout the country.
 - Create opportunities for anesthesia equipment and/or accessories and spare parts to be manufactured locally.
 3. Revise Minimum Acceptable Specifications for Anesthesia Machines, Monitoring Devices and Other Related Equipment
 - During the purchase of machines, monitors, etc., the national specification standard as developed by FMHACA should be met.
 - The specifications need revision to incorporate missed essential equipment required for provision of safe anesthesia. (See Annex)
 4. Create a Forum for the Dissemination of Updated Lists and Specifications

As continuation of the above interventions, a national forum should be organized to disseminate the updated list of drugs and equipment in anesthesia. The forum needs to include as members the following:

1. Representatives of FMHCA
2. Representative from FMOH
3. Representatives from PFSA
4. Representative from Ethiopian Association of Anesthetists
5. Representative from Anesthesiology Society

6. One representative from Regional Health Bureau
 7. Representatives from private pharmaceuticals importers
 8. Representative from pharmacy and pharmacology associations
 9. Representatives from all health professional associations (Ethiopian Medical Association, Ethiopian Nursing Association, Ethiopian Midwifery Association, Ethiopian Laboratory Science, Ethiopian Radiology Association, Ethiopian Public Health Association)
 10. Universities and Regional Health Science Conducting Anesthesia training
 11. Bioequivalence centre (located @ AAU)
5. Review and Revise Guidelines for Maintenance and Repair of Anesthesia Equipment.
- Train biomed technicians for each region.
 - Improve anesthesia equipment auditing.

Annexes

Annex I Enrollments

Table.1. Proposed residents' enrollment for anesthesiology programmes

Training Institution	2017	2018	2019	2020	2021	End of 2021
Addis Ababa University	25	25	25	25	25	125
Jimma University	10	15	15	15	15	70
St. Paul MMC	10	15	15	15	15	70
University of Gondar	5	5	5	5	5	25
Mekele University	5	5	5	5	5	25
Hawassa University	5	5	5	5	5	25
Bahir Dar University	5	5	5	5	5	25
Haromaya University	5	5	5	5	5	25
Adama University	5	5	5	5	5	25
Arbaminich University	5	5	5	5	5	25
Armed Forces Hospital	5	5	5	5	5	25
Sodo Christian hospital	3	3	3	3	3	15
	88	98	98	98	98	480

Table.2. Proposed enrollment for MSc in Anesthesia programmes

S.No	Training Institution	Expected Graduates					Total	Remark
		2017	2018	2019	2020	2021		
1.	Addis Ababa University	19	25	25	25	25	119	
2.	University of Gondar	6	12	12	12	12	54	
3.	Jimma University		10	10	10	10	40	New program
4.	Mekele University		12	12	12	12	48	New program
5.	Dilla University		8	8	8	8	32	New program
6.	Wolaita Sodo University		8	8	8	8	32	New program
Total		25	75	75	75	75	325	

Table.3. Proposed enrollment for BSc in Anesthesia programmes

S.No	Training Institution	Expected Graduates					Total
		2017	2018	2019	2020	2021	
1	Addis Ababa University	48	30	30	50	50	208
2	University of Gondar	35	33	70	50	50	238
3	Jimma University	29	28	31	31	31	150
4	Mekele University	17	24	25	25	25	116
5	Dilla University	20	15	20	20	20	95
6	Wolaita Sodo University	16	12	16	16	16	76
7	Debre Tabor University	14	20	20	20	20	94
8	Dire Dawa University	30	32	20	20	20	122
9	Axum University	15	20	22	22	22	101
10	Hawassa University	22	20	28	28	28	126
11	Arsi University	-	14	22	22	22	80
12	Arbaminich University	-	22	25	25	25	97
13	Wollo University	-	-	25	25	25	75
14	D/Birhan University	-	-	15	15	15	45
15	Harar HSC (Post Basic)	-	-	22	22	22	66
16	Menelik II HSC(Post Basic)	17	9	17	17	17	77
17	Wachemo University	-	-	30	30	30	90
18	Bahirdar University	-	-	-	15	15	30
19	Ambo University	-	-	10	10	10	30
Total		263	279	448	463	463	1916

Table.4. Proposed enrollment for Level V Anesthetic nursing programme

Region	Health Science College	2017	2018	2019	2020	2021	Total
Harari	Harari	25	25	25	25	25	125
Amhara	Dessie	20	20	20	20	20	100
	Teda	20	20	20	20	20	100
	Bahir Dar	20	20	20	20	20	100
Tigray	Dr. Tewelde	20	20	20	20	20	100
	Araya kahisu	20	20	20	20	20	100
SNNPR	Hawassa	20	20	20	20	20	100
	Hosanna	12	12	12	12	12	60
	Arba Minch	15	15	15	15	15	75
Oromia	Shashamene	20	20	20	20	20	100
	Adama Hospital Medical College	25	25	25	25	25	125
	Nekemte	20	20	20	20	20	100
	Metu	10	10	10	10	10	10
Somali	Jigjiga	25	25	25	25	25	125

Annex II Specifications of Anesthetics & Ancillary Equipment

I. Equipment

According to FMHACA's Essential List of Medical Instruments with Minimum Standard/Specifications, the minimum specification for anesthesia machines and some monitoring devices has been prepared as follows:⁶

1- Anesthesia machine, with vent. 2 vap. open

General Description:

Anaesthesia system, free-standing, with accessories

Technical Specifications:

- Autonomous system integrates an anaesthesia machine, a ventilator and an oxygen concentrator
- Suitable for all patient categories: paediatric and adult
- Sturdy and stable construction on 4 antistatic ball-bearing swivel castors, 2 with breaks
- Trolley with upper shelf and medical utility rail

Anaesthesia Machine

- Open circuit configuration
- Selectatec vaporising system
- With two vaporizers for Selectatec vaporising system, with interlock fixation system
- Gas mixing unit uses ventilator compressor (ambient air) or oxygen concentrator (ambient air/O₂)
- Mixer secures a minimum of 25 % oxygen in gas mix
- Non-return and three way valve, with connecting tube
- Gas analyser

Ventilator:

- Volumetric ventilator
- Built-in electrically powered compressor: 0 to 25 L/min
- Built in battery (rechargeable)
- Ascending/piston type bellows

⁶ Ethiopian Food, Medicine and Health Care Administration and Control Authority (FMHACA), National medical equipment specification 201X

- Ventilation modes: SV, MV, CV, ACV
- Tidal volume: 30 - 1000 ml
- Respiratory rate: 8 to 40 cycles/min
- FiO₂: 0.21 - 0.90
- I/E ratio: 1/3 to 1/1
- Inspiration pressure: 0 to 80 mbar
- Trigger sensitivity: 0 to -20 mbar
- Minimum pressure alarm: 0 to 60 mbar
- Front panel shows system status, errors and failure (low oxygen concentration, low/high pressure, power failure, low volume of inhalational agents)
- Audio-visual alert on low/high pressure, power failure

Oxygen Concentrator Set:

- Integrated oxygen sensing device (OSD)
- Output measured via integrated flow meter
- Operating temperature: 10 to 35 C
- Operating relative humidity: max 75 %
- Output pressure, approximately: 620 mbar
- Flow range adjustable: 0.5 to 5 L/min
- Concentration at 5 L/min: 93% ± 3%
- Sound level: max 40 to 50 dB(A)
- Display shows system status, errors and failure (low oxygen concentration, low/high pressure, power failure)
- Audio-visual alert on low oxygen concentration and power failure
- Power requirement: 220V ± 15%, 50 Hz
- Power consumption, system approximately: 800 W

Supplied With:

- 1 x Medical rail to mount second vaporizer
- 1 x Paediatric reusable breathing circuit (tubes / balloons / valves / masks)
- 1 x Adult reusable breathing circuits (tubes / balloons / valves / masks)
- 1 x Spare parts/maintenance kit (air filters, tubing, O-rings) for oxygen concentrator and ventilator
- 1 x Set of spare fuses

- Clear instructions for use/ diagrams for assembly in 3 languages (English, French and Spanish), list of accessories/ parts

2. Defibrillator, basic

General Description: Defibrillator, basic, w/access

Technical Specifications:

- Basic portable defibrillator with monitor and printer
- Synchronized and direct defibrillation
- Biphasic energy waveform, adjustable output, from approx. 5 up to 300 J
- Load compensation circuit allows precise delivery of selected energy based on patients' impedance
- Shock resistant housing allows system to function in demanding environment
- Integrated carry handle facilitates transport
- Splash-resistant alphanumeric function keys
- Bright back-lit alphanumeric LCD, approximately: 8 x 6 cm
- Display shows ECG, Heart rate, Battery status and Energy output preset
- Heart rate range, approximate: 20 to 300 beats per minute (bpm)
- ECG circuit protected from defibrillator operation
- Self-test is performed each time the device is switched on
- System reports status, operation, malfunctions (electrodes), out-of-paper & low battery, with audiovisual alert
- Continuous check on the quality of electrodes connection, audio visual alert on loss of signal
- External flat paddles, colour coded, with manual recording buttons, 2 m power cord
- Internal safety discharge upon 40 sec non-delivery of accumulated energy, switch-off & technical failure
- Standard 1 mV signal for approximation of wave amplitude is continuously displayed
- With internal memory capable of recording events and ECG
- Data communication interface: RS232, BNC, USB or equivalent
- Built-in high-resolution 200 dpi thermal printer, width approx 6 cm
- Printer has manual and automatic mode, and records displayed parameters and ECG
- Paper speed, adjustable: 5, 25 and 50 mm/sec
- Sensitivity, adjustable: 5, 10 and 20 mm/mV

- Transformer and charger are integrated in the device
- Rechargeable battery is removable/replaceable by the operator
- Battery capacity, approx 50 shocks of 300 J with 2 hours continuous monitoring
- Recharge time max 10 sec
- Charge/ready is indicated via audio/visual indicator

Supplied with:

- 1 x Patient cable
- 1 x Pair of adults paddles
- 1 x Pair of pediatric paddles
- 1 x Pack of 100 single use electrodes
- 1 x Set of 10 rolls thermal paper, 50 m
- 2 x Bottles of electrode gel, approximately 350 ml
- 1 x Spare rechargeable battery pack (removable/ replaceable by the operator)
- 1 x Set of spare fuses
- 1 x Plastic protective dustcover
- Clear instructions for use/diagrams for assembly in English language, list of accessories/ parts
- Power requirements: 220 V/ 50 Hz and internal rechargeable battery

3. Automatic External Defibrillator

General Description:

Automated External Defibrillator (AED), with accessories

Technical Specifications:

- Basic portable Automated External Defibrillator (AED)
- Operation is immediate, self-explanatory and based on intuitively understood design features
- Shock and splash resistant housing allows functioning in demanding environment
- Self-test is performed upon each switched on: Ready-For-Use is indicated
- Automated assessment and analysis adequately sensitive and specific for children and adults
- Step-by-step guidance from large pictograms on the device: On, Analyze, Shock
- With self-adhesive external pads, colour coded, with pictogram
- Automated direct defibrillation, energy waveform, biphasic max approx 250 J
- Built-in load compensation algorithm adjusts energy delivery according patient's impedance
- Standard pads fit for children (> 8 yr or > 25 kg) and adults
- For infants (> 1 yr or > 6 kg) attenuation pads are provided, reduction to max approx 50J
- Pads with plug and power cord, length approx: 100 cm
- Built-in audible metronome assists Cardiac Pulmonary Resuscitation (CPR)
- Audiovisual alerts on operational status, malfunctions (electrodes) and low battery
- Internal discharge of accumulated energy upon: 40 sec non-delivery, switch-off or malfunction

- **Power requirements:**
- Operates on set of replaceable batteries, type 9V PP3 / 6LR61
- Battery capacity, approx: 50 shocks of 250 J
- Power requirements: internal batteries

- **Supplied with:**
- 1 x Set of children/adult self-adhesive external pads, colour coded, with pictogram
- 1 x Set of infant attenuated adhesive external pads, colour coded, with pictogram
- 1 x Plastic-sealed Quick Reference Guide covering step-by-step AED as well as CPR
- 1 x CD containing training material
- 1 x Set of batteries 9 V PP3/6LR61 (separately packed)
- 1 x Carry case with storage pocket for leads and other accessories
- Clear instructions for use/diagrams for assembly in English languages, list of accessories/parts

4. Ventilator with patient monitor

General Description: Patient monitor with ECG, Pulse oximeter and ventilator for adult and infant

Technical Specifications:

- Basic automatic ventilator for all patient categories
- Sturdy and stable constructed on antistatic ball-bearing swivel castors, with breaks
- Construction allows frequent dismantling for cleaning and disinfection
- Handle facilitates positioning of the device
- Integrated electronically controlled electrically powered compressor
- With air-oxygen mixer
- Humidifier for extended ventilation, provided with fixation for bottle
- Patient selection: Pediatric – Adult

Breathe types:

- Volume Control (VC)
- Pressure Control (PC)
- Volume Target Pressure Control (VTPC)

Modes:

- Controlled Mandatory Ventilation (CMV)
- Synchronized Intermittent Mandatory Ventilation (SIMV)
- Continuous Positive Airway Pressure (CPAP)
- Positive End Expiration Pressure (PEEP)

Controls and settings:

- Pressure support, approximately: 0 - 80 mbar
- Expiratory threshold, approximately: 5 - 50 %
- Tidal volume, approximately: 20 - 1000 ml (ped), 100 - 3000 ml (adult)
- Frequency, approximately: 1 - 120 cycles/min (pediatric), 1 - 80 cycles/min (adult)
- Inspiratory flow, approximately: 1 - 100 L/min (pediatric), 1 - 180 L/min (adult)
- Inspiratory time, approximately: 0.1 - 3.0 sec (pediatric), 0.1 - 5.0 sec (adult)
- I:E ratio maximum approximately: 4:1
- Pressure trigger sensitivity, approximately: 0 to -5.0 mbar
- Volume trigger sensitivity, approximately: 0.1 - 2.0 L/min (ped), 0.6 - 2.0 sec (adult)
- FiO₂ from approximately: 0.21 - 1.00
- PEEP/CPAP approximately: 0 - 30 mbar (ped), 0 - 45 mbar (adult)
- Air filter capacity at inlet: 99 % (for > 0.5 µm)
- Audible visual alarms for:
 - High/low airway pressure
 - High/low inspiratory minute volume
 - High/low respiration frequency
 - Power failure (battery)
 - Silencing feature for audio alarms
- Large back-lite display shows operation with set and measured values
- Self-diagnosis with each start-up and integrity testing of all system parameters every 5 minutes
- Front panel reports systems errors and status of built-in battery
- With adjustable patient-circuit support arm
- Built-in rechargeable battery, autonomy approximately 2 hrs
- Automatic switch to battery in case of power failure, automatic recharge when connected to mains

Power requirements: 220 V/50 Hz and rechargeable battery

Supplied with:

- 1 x Accessory storage basket fixed to the unit
- 1 x Pediatric reusable breathing circuit (tubes/balloons/valves/masks)
- 1 x Adult reusable breathing circuits (tubes/balloons/valves/masks)
- 1 x Spare humidifier bottle

- 1 x Spare parts/maintenance kit (air filters, tubing, O-rings)
- 1 x Spare rechargeable battery pack
- 1 x Set of spare fuses
- Clear instructions for use/diagrams for assembly in 3 languages (English, French and Spanish), list of accessories/parts

5. Integrated monitors

Specifications

1. Patient monitors should be 8 “ or more color modular medical grade monitor, multi channel monitor.
2. It should monitor following Parameters:
 - ECG (5 lead/3leads), ST analysis,
 - SPO₂,
 - Respiration,
 - NIBP adult and pediatric,
 - Temp,
 - Invasive pressures
 - ETCO₂.plus neuro-muscular and BIS as optional
 - Trend graphic and numeric memory for 24 hrs or more.
 - It should have monitoring anesthesia agent
 - It should have FiO₂ cell with long life.
 - Auto identification of all Anesthetic five agent with facility of MAC display desirable
 - The whole anesthesia unit with monitor should be with suitable UPS
 - Accessories to be offered as standard with each monitor
 - ECG/respiration 5 leads cable : 2/unit
 - Non invasive BP cuff adult : 2/unit
 - Noninvasive BP Pediatric : 2/unit
 - Pulse oximetry finger probe adult : 2/unit
 - Temperature probe general purpose reusable: 2/unit
 - Reusable IBP and CVP transducer: 2/unit with disposable domes 10 units
 - Accessories 2/unit
 - ETCO₂One suitable container lockable for keeping consumables

6. Pulse oximetry

General Description: Non-invasive measurement of oxygen saturation and pulse rate with colour graphic screen for adult and infants.

Technical Specifications:

- Display of oxygen saturation and pulse rate.

- Oxygen saturation measurement range from 0 -100%.
- Pulse strength perfusion indication
- Capability of Plethysmography.
- Pulse rate measurement from 20-250 bpm.
- Visual and audible indication of alarms.
- High and low alarms settings.
- Adult finger and pediatric sensor (reusable type)

Power requirements:

- Power of 220 V/50 Hz.
- Built-in re-chargeable battery

Capnograph

General Description: Adult, Pediatric and neonatal

Technical Specifications:

Display : 12.1" colour active matrix TFT

- Resolution : 800x600
- Trace : 7 waveforms
- Sweep Speed : 12.5, 25, 50 mm/s
- Alarm indicator light
- Power indicator light
- Audio Indicators for QRS beep and alarm sound
- Interface : Networking
- Battery : Rechargeable
- Trend time : 1~72 hours
- Alarm : 3-level audible and visual alarm
- Recorder : Built-in, thermal array, 3 channels

ECG

- Lead Type : 5-lead
- Input : 5-lead (RA; LA; RL; LL; V)
- Lead Selection : 5-Lead; I; II; III
- ECG Waveform : 1 channel
- Gain Selection : x0.5, x1, x2, auto
- Sweep Speed : 12.5 mm/s, 25 mm/s
- Heart rate range: 25~200 BPM

Accuracy: 1BPM

- Anti-electrosurgical interference and defibrillation
- Standard Configuration

- ECG, RESP, NIBP,TEMP,SPO2
- EtCO2 Micro Stream Latest Technology Modular Cassette.
- IBP, FHR Module, Thermal, Recorder Battery, Wall Mounting, Trolley
- CMRR: Diagnostic mode:>60db
- Monitor mode:>60db
- S-T detection
- Measurement range: -20mV-2.0mV
- Arrhythmia analysis
- Alarm audible and visual alarm, alarm events recallable

Respiration

- Method: RA-LL impedance
- Measurement Range: 20~250BrPM
- Resolution: 1BrPM

Accuracy: 2% or 2BrPM, whichever is greater

- Apnea Alarm, and apnea delay:10~40seconds

5. Digital Blood Pressure Monitor Machine

General Description: Digital Blood Pressure Monitor with One-touch operation

Technical Specifications:

- Blood pressure and pulse measurements
- Fully automatic inflation and deflation
- Memory
- Error Code
- Jumbo display
- Automatic Switch off
- Battery check
- Oscillometric measuring method
- High accuracy

Power requirements:

- Power of 220 V/50 Hz.
- Built-in re-chargeable battery

6. Mercury BP/ Sphygmomanometer

General Description: Mercury sphygmomanometer

Technical Specifications:

- Portable/desk,
- With oversize, metal housing
- Colors (red, blue, green, yellow, black and silver),
- With chromed metal air release valve, bulb and cuff with 2-tube latex bladder
- Precision glass tube with inside diameter not less than 3.5 mm
- Graduated scale to 300 mmHg, through clear and accurate scale markings
- Mercury lock
- Accuracy +/- 3 mm Hg
- Certificate: *CE-mark*

2: Recommended Anaesthetics and Adjuvants

General Anaesthetics

1. EnfluraneInhalation, 250ml
2. Etomidate..... Injection, 20mg/ml in 10 and 20ml ampoule
3. HalothaneInhalation, 250ml
4. Isoflurane.....Inhalation, 100ml, 250ml
5. Ketamine HydrochlorideInjection, 10mg/ml in 20ml,50mg/ml in 10 ml ampoule
6. Nitrous oxide.....Inhalation
7. Propofol.....Injection (emulsion), 10mg/ml in 20ml ampoule Injection, 1%, 20ml;1%, 50ml; 2%
8. Sevoflurane..... Inhalation, 250ml
9. Thiopental SodiumPowder for injection, 0.5g,1gm in vial
10. Benzodiazepines
 - a. Midazolam
 - b. Diazepam

Neuromuscular Blockers

1. Suxamethonium Chloride(Succinylcholine).....Powder for injection, 50mg, 100mg, 500mg in vial Injection, 50mg/ml
2. Vecuronium BromidePowder for injection, 10mg in vial
3. Pancuronium Bromide Injection, 2mg/ml in 2ml ampoule vial
4. Rocuronium..... Injection 5mg/ml,10mg/ml in 10or 25 or 50 ml
5. Atracurium Besylate.....Powder for injection, 10mg/ml in 2.5ml, 5ml, 25ml ampoule
6. CisatracuriumInjection, 2mg/ml in 10ml ampoule
7. MivacuriumInjection 2mg/ml

Anaesthetics Adjuncts and Adjuvants

1. Atropine SulphateInjection (Sulphate), 1mg/ml
2. FentanylInjection, 0.05mg/ml
3. Morphine
4. Remifentanyl
5. Sufentanyl

6. Pethidine
7. Hydromorphone
8. Tramadol
9. Paracetamol IV
10. Magnesium sulphate (MgSO₄)
11. NSAIDs(diclofenac and ketorolac)
12. Metoclopramide
13. Ondansetron
14. Non particulate anti acid(sodium citrate)
15. H₂ receptor blockers (cimetidine, ranitidine)
16. Proton pump inhibitors (omeprazole)
17. Glycopyrronium Bromide(Glycopyrrolate).....Injection, 0.2mg/ml
18. Hyoscine HydrobromideInjection, (Sulphate), 0.4mg/ml,0.6mg/ml,
1mg/ml in 1ml ampoule
19. Neostigmine..... Injection, 0.5mg/ml, 2.5mg/ml in 1ml ampoule

Local Anaesthetics

1. Spinal Bupivacaine
2. Bupivacaine..... Injection, 0.2%, 0.5% (10ml, 20ml) preservative free
3. Bupivacaine-----injection 0.2%, 0.5% (20ml) non-preservative free
4. Levobupivacaine
5. Ropivacaine
6. Cocaine HydrochlorideTopical solution, 4%
7. Ethyl ChlorideSpray, 50ml
8. Lidocaine HydrochlorideCartridges, 2% in 1.8ml
Injection, 0.5%, 1%, 2%, 5%
Jelly, 2% in 30ml
Ointment, 5% in 10gm
Spray, 2%, 4%, 10% in 80g
9. Lidocaine Hydrochloride +Adrenaline.....Injection, 1%+1:200, 000 in 20ml vial, Injection,
2%+1:200,000 in 20ml vials
10. Tetracaine HydrochlorideInjection, 0.5%, 2%, 4% in 2ml vial

Utilities

1. Oxygen cylinder (E-cylinder).....(white/green/coloured cylinder)
2. Oxygen gauge with Regulator
3. Oxygen concentrator
4. Anaesthesia trolley
5. Power dividers
6. Soda lime, Carbon Dioxide Adsorbent

Resuscitation Drugs

S.N ^o	Resuscitation Drugs	Requirement			Unit
		Vital	Essential	Less essential	
1.	Adrenalin 1mg/ml	√			Amp.
2.	Atropine 1mg/ml	√			Amp
3.	Ephedrine 20/50mg/ml	√			Amp
4.	Phenylephrine 10mg/ml	√			Vial
5.	Noradrenalin 2mg/amp	√			Amp
6.	Esmolol 100mg/10ml	√			Vial
7.	Propranolol	√			Amp
8.	Diphenhydramine	√			Ampl
9.	Naloxone	√			Ampl
10.	Dantroline	√			Vial
11.	Flumazenil	√			Ampul
12.	Aminophylline	√			Amp
13.	Clonidine	√			Amp
14.	Dexmedetomidine	√			Amp
15.	Furosemide	√			Amp
16.	Verapamil 5ml/amp	√			Vial
17.	Adenosine	√			Vial
18.	Labetelol 10mg/10ml	√			Vial

S.N ^o	Resuscitation Drugs	Requirement			Unit
		Vital	Essential	Less essential	
19.	Dopamine 200mg/2ml	√			Vial
20.	Dobutamine 250mg/vial	√			Vial
21.	Metoprolol 5mg/ml amp	√			Vial
22.	Digoxin 0.5mg/ml for IV	√			Amp
23.	Amiodarone 15mg/ml for IV	√			Amp
24.	Nitroglycerine	√			Vial
25.	Hydralazine 515mg/amp	√			Amp
26.	KCL 20MIQ/10CC	√			Vial
27.	Hydrocortisone 100mg inj	√			Amp
28.	Dexamethasone 4 mg/2cc	√			Vial
29.	Mannitol 20% - 200cc	√			Bottle
30.	Salbutamol puff	√			Bottle
31.	Calcium Gluconate 10%-10cc	√			Amp
32.	Paracetamol suppository 125mg/suppository - 10/pack	√			Pack
33.	Sodium bicarbonate injection	√			Vial
34.	heparin 5000iu/ml of 25 vial	√			Vial
35.	Protamine		√		
36.	40-50% glucose -20ml/vial	√			Vial
37.	Oxygen	√			
38.	0.9% normal saline	√			Bag
39.	Ringer lactate	√			Bag
40.	0.9% DNS	√			Bag
41.	5% DW	√			Bag
42.	3% Hypertonic Saline	√			Bag

IV: Anaesthesia and Critical Care

No.	Procedure	Health Centre	Primary hospital	General hospital	Tertiary Hospital
1	Local Anesthesia	+	+	+	+
2	General anesthesia		+	+	+
3	Regional anesthesia		+	+	+
4	Spinal anesthesia		+	+	+
5	Epidural anesthesia/analgesia			+	+
6	Peripheral nerve blocks		+	+	+
7	Procedural sedation		+	+	+
8	Central venous catheter insertion				+
9	Arterial catheter insertion				+
10	Fiber optic intubation				+
11	Blood patch			+	+
12	Advanced traumatic life support (ATLS), Pediatrics advanced life support(PALS)		+	+	+
13	Basic traumatic life support (BTLS)	+	+	+	+
14	Intubation/ Extubation		+	+	+
15	Mechanical ventilation		+	+	+

V. Anesthetics drugs

Procedure	Non-consumables	Consumable drugs	Consumable equipment /utensils
Local anesthesia		Lidocain 1% with adrenalin	Glove
		Lidocain 2% with adrenalin	d. syringe
		Lidocain 1% with out adrenalin	
		Lidocain 2% with out adrenalin	
		Bupivacaine 0.5%	
General anesthesia	Anesthesia machine	Halothane	Endotracheal tube 2.5 to 8.5
	Ambu bag	Isoflurane	Double lumen tube 35-42
	Oral airways	sevoflurane	Suction tip
	Nasal airways	succinylcholine	Disposable gloves
	perfuser	rocuronium	NG tube
	Patient monitor	vecuronium	Urinary Catheter
	Patient monitor for transport	pancuronium	
	Esophageal sthetoscope	atracurium	
	Blood? Flid pumper	cisatricurium	
	Warming blanket	Thiopental	
	Mechanical ventilator for transport	ketamine	
	Suction machine	propofol	
	Capnogram	etomidate	
	Portable pulse oximeter	pethidine	
	Blood warmer	Fentanyl	
	laryngoscope	sufentany	
	Sthetoscope	morphine	
	Manual BP apparatus	Alfentanyl	
	Oxygen guage	Diazepam	
	Oxygen cylinder	Midazolam	
	Bugie	Atropine	
	Stylet pedi	Glycopyrolate	
	Anesthesia trolley	Lidocain IV	

	Oxygen concentrator	Furosemide IV	
		Mannitol	
		Noradrenalin	
		Dopamine	
		Dobutamine	
		Phenylephrine	
		Ephedrine	
		Labetolol	
		Metoprolo	
		Propranolol	
		Hydralazine	
		Adrenaline	
		Amiodarone	
		Naloxone	
		Neostigmine	
		40% glucose	
		Aminophyline	
		Salbutamol inhaler	
		Intralipid	
		Dantrolene	
		Esmolol	
		Hydrocortisone	
		Dexamethasone	
		Ondansetrone	
		Metochloropromide	
		NS	
		DNS	
		RL	
Regional			
Spinal Anesthesia	Spinal set	Lidocain 5%	Spinal needle 22-26
	Forceps	Bupivacaine 0.5%	d. syringe
	Sterile gauze	Phenylephrine	Surgical glove
	Spinal needle 22-26	Ephedrine	
	Kidney dish	Adrenalin	
	Monitors	Iodine	
	Manual BP	Alcohol	
	Portable Pulse oximeter	Normal saline	
		Ringer lactate	
Epidural Anesthesia			
	Patient monitor	Bupivacaine	Epidural set
	Pulse oximeter	Lidocain	Epidural needle

	Manual BP	Morphine	Loss of resistance syringe
		Fentanyl	Epidural catheter
		Adrenalin	Tegaderm
		Ephedrine	
		Phenylephrine	
		Iodine	
		Alcohol	
		norepinephrine	
Peripheral nerve Block			
	Nerve stimulator	Bupivacaine 0.5%	Insulated nerve block needles
	Ultrasound	Lidocain 1%	d. syringe
	Monitors	Bupivacaine 0.25%	
	Mannula BP	NS	
	Portable pulse ox meter	RL	
		Sterile water	
		Adrenalin	
		Iodine	
		Alcohol	
		Norepinephrine	
		Ephedrine	
Central venous catheter insertion			
	Monitor with CVP	Normal saline	Central venous catheterization set
		Iodine	
		Lidocaine	
		Alcohol	
Arterial catheterization			
	Monitor with Arterial blood pressure (ABP)	Lidocaine	Arterial line set with module
		Normal saline	D. syringe
			Surgical glove
Critical care			
Mechanical ventilation	ICU Mechanical ventilator	ACLS set	ACLS set
	ICU Patient monitor		
	ACLS set		

3: List of Medical Equipment Required for practice

S.N ^o	Equipment	Requirement			Unit
		Vital	Essential	Less essential	
1.	Defibrillator, biphasic and monophasic	√			
2.	None invasive CPAP Machine	√			
3.	None invasive CPAP Machine tight fitting mask	√			
4.	Mechanical Ventilator portable	√			
5.	Anesthesia machine with isoflurane and halothane vaporizers	√			
6.	Anesthesia machine with isoflurane and Sevoflurane vaporizers	√			
7.	ECG monitor with all accessories	√			
8.	Transducer and module for invasive and none invasive monitoring	√			
9.	12 lead ECG Machine	√			
10.	Ultrasound portable for peripheral nerve blocks	√			
11.	Echo cardiograph	√			
12.	Trans esophageal echocardiography	√			
13.	Fiberoptic bronchoscope adult and pediatric	√			
14.	Glidescope with adult and pediatric handles	√			
15.	Suction machine	√			
16.	Glucometer with adequate strips	√			
17.	Capnogram	√			
18.	Portable pulse oxy	√			
19.	Blood/fluid warmer	√			
20.	Stethoscope	√			
21.	Blood Pressure Apparatus adult and pediatrics	√			

22.	Laryngoscope set	√			
23.	L laryngoscope bulb	√			
24.	Laryngoscope with inbuilt light				
25.	McIntosh and Miller laryngoscope				
26.	pulse oximeter probe adult and pediatric	√			
27.	IV medicine infusion pump, electrically powered	√			
28.	pulse oximeter probe pediatric	√			
29.	pediatric heat mattress	√			
30.	Stretcher	√			
31.	Nerve stimulator and insulated needles	√			
32.	Insulin syringes				
33.	Droppers for pediatric Fluid administration				
34.	Room heaters				
35.	Warming blankets				
36.	Video laryngoscope (McGrath and Glideslope)				
37.	monitors with invasive cords and display				

4: Medical Consumables and Accessory Equipment

S.N ^o	Consumable/ Accessory	Requirement			Unit
		Vital	Essential	Less essential	
1.	Distil water 10cc/vial/100/box	√			
2.	Disposable syringe 5cc	√			
3.	Disposable syringe 10cc	√			
4.	Disposable syringe 30cc	√			
5.	Disposable syringe 50cc	√			
6.	Disposable syringe 3cc	√			
7.	Needle for local anesthesia 24-26G	√			
8.	Three way valve	√			
9.	Adhesive Plaster transparent	√			
10.	Suction tube	√			
11.	CVP set	√			
12.	Arterial line set	√			
13.	Nasal airway	√			
14.	Oral airway	√			
15.	Ambu bag	√			
16.	Oxygen administration prong	√			
17.	Oxygen delivery face simple mask with tubing	√			
18.	Non-rebirthing face mask	√			
19.	Anesthesia face mask different size (neonate – adult)	√			
20.	Epidural set	√			
21.	Spinal needle 22- 27G all type (possibly pencil point)	√			
22.	Insulated catheter for nerve block	√			
23.	Endotracheal tube sizes of 2.0 mm- 5.5 mm(130 from each size)	√			

S.N ^o	Consumable/ Accessory	Requirement			Unit
		Vital	Essential	Less essential	
24.	Endotracheal tube sizes of 6.0mm- 8.5mm (600 from each size)	√			
25.	Double lumen tube 26fr, 35fr and 37fr (both right & left 120 from each size)	√			
26.	RAE Endotracheal tube for ENT operations	√			
27.	Reinforced ETT				
28.	Alcohol	√			
29.	Iodine 2%	√			
30.	Bandage	√			
31.	Gauze surgical	√			
32.	IV canola 20, 24, 18, 16 (400, 600, 6000, 1000 consecutively)	√			
33.	Soda lime 5kg	√			
34.	Fluid pumper	√			
35.	Drug cabin with locker	√			
36.	ECG Pad	√			
37.	Stylet	√			
38.	Bougie	√			
39.	Ventilating bougie				
40.	Magill's forceps				
41.	LMA (different sizes)				
42.	Breathing circuit adult	√			
43.	Breathing circuit pediatrics				
44.	ICU mechanical ventilator breathing circuit adult	√			
45.	ICU mechanical ventilator breathing circuit pediatrics	√			

S.N ^o	Consumable/ Accessory	Requirement			Unit
		Vital	Essential	Less essential	
46.	Mechanical ventilator HME Filter	√			
47.	Pulse oximeter probe for adults	√			
48.	Pulse oximeter probe for pediatrics	√			
49.	K –y jelly	√			
50.	Transducers	√			

5: Recommended SDL Equipment & Materials for Anesthesia Education

AA

S.N ^o .	Competency to be achieved	Required Equipment	Quantity
1.	Managing patient airway (Basic & Advanced)	1. Different size endotracheal tube	03 From each size
		2. Double lumen tube (4 Different sizes)	02 From each size
		3. Set of laryngoscopes (With 5 Different size blades)	04 Sets
		4. Oropharyngeal airways (Different sizes)	03 From each size
		5. Nasopharyngeal airways (Different sizes)	03 From each size
		6. Face mask (Different sizes)	03 From each size
		7. Self-inflating bag (Ambu-bag) (Adult & Ped. sizes)	03 From each size
		8. Laryngeal Mask Airways (LMAs) (Different sizes)	03 From each size
		9. Stylets (Adult & Pediatrics sizes)	03 From each size
		10. Bougie (Adult & Pediatrics sizes)	03 From each size
		11. Combitube (adult)	05 Pieces
		12. Magill forceps	05 Pieces
		13. Fiberoptic with light source	02 Pieces
		14. GlideScope	05 Pieces
		15. Intubation mannequin	05 Pieces
		16. Suction catheter	10 Pieces
		17. Suction Machine	02 Pieces
		18. Esophageal Detector Device (EDD)	05 Pieces
		19. Combi-tube	03 Pieces
		20. Cricothyroidotomy kit	05 Pieces
		21. Nasal cannula	10 Pieces
		22. Spatula	01 Pack
		23. Tongue forceps	03 Pieces
		24. Mouth gag	03 Pieces
		25. Adhesive tape	03 Rolls
		26. Difficult airway management guideline	10 Copies
2.	Administering General Anesthesia	27. Anesthesia machine with vaporizers	01 Piece
		28. Breathing circuits (Different)	02 From Each
		29. Anesthesia Machine functionality checklist	50 Copies
3.	Monitoring of patient status	30. Electrocardiogram (ECG)	01 Piece
		31. Capnography to measure ETCO ₂	01 Piece
		32. Pulse oximetry	02 Pieces
		33. Thermometer	10 Pieces
		34. Oscillometer	02 Pieces
		35. Sphygmomanometer	05 Pieces
		36. Trans thoracic echocardiography machine	01 Piece

S.N ^o .	Competency to be achieved	Required Equipment	Quantity
		37. Trans esophageal echocardiography machine	05 Pieces
		38. CVP set	05 Pieces
		39. Arterial line set	05 Pieces
4.	Administering Regional anesthesia	40. 22-25 and 27-gauge LP NEEDLES	10 from each size
		41. Introducer for 27 G needle	10 Pieces
		42. 16/18G Tuohy needle for epidural anesthesia	10 Pieces
		43. sponge forceps/ artery	10 Pieces
		44. Bandage	01 Roll
		45. Epidural and spinal anesthesia mannequins	03 of Each
		46. Alcohol 70%	01 Bottle
		47. Iodine	01 Bottle
		48. Savulone	01 Bottle
		49. Surgical gloves (6½, 7 and 7½ sizes)	50 Pairs each
		50. Epidural catheter tray (full kit)	20 Sets/ kits
		51. Insulated catheter for nerve block (50&100 mm)	30 of Each
		52. Ultrasound guided PNB simulator	02 Pieces
53. Local anesthetic toxicity management algorithm	10 Copies		
5.	Provision of Emergency Critical care	54. Monopolar & Bipolar Defibrillators	02 Pieces
		55. IV fluid with set	10 Sets
		56. IV cannula (18,20,22 and 24G)	10 From Each
		57. Resuscitation guideline (adult and neonate)	10 Copies
		58. CPR mannequin adult	10 Pieces
		59. CPR mannequin pediatrics	5 Pieces
		60. Newborn model	5 Pieces
		61. Anaphylaxis management guideline	10 Copies
		62. Malignant hyperthermia management guideline	10 Copies
		63. Tachy & bradyarrhythmia management algorithms	10 Copies
		64. Mechanical ventilator	02 Pieces
6.	Infection Prevention and patient safety	65. Printed copy of Anesthesia record sheet	100 Copies
		66. Infection prevention guideline	50 Copes
		67. WHO Surgical safety checklist	50 Copes
		68. Postoperative patient handover guidelines	50 Copes
		69. Bleach solution	05 Bottle

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