

Anesthesia in Low-Resourced Settings

Near Misses and Lessons
Learned

John G. Brock-Utne



Springer

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ISBN 978-3-030-77653-4 ISBN 978-3-030-77654-1 (eBook)
<https://doi.org/10.1007/978-3-030-77654-1>

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The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

For the next generation

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Foreword

Historically, the medical mission trip was the most common form of engagement in Global Health by anesthesiologists. In generations past, “mission” had a different meaning. Albert Schweitzer, a humanitarian and physician, won the Nobel Peace Prize in 1952 largely for his philosophy, “Reverence for Life”. His most notable work was the foundation of a hospital in Gabon in 1913, a hospital that has been rebuilt twice, but still provides service and sees patients today.

Over time, Global Health has evolved into its own field of study and has largely shifted focus towards building local capacity to strengthen healthcare systems through education and research. Many Global Health experts have even called into question the value and motivations of short-term, service-based “mission” work, citing ethical considerations and neocolonialism.

However, if you ask the countless patients whose lives have been changed from recto-vaginal fistula repairs when local surgeons do not exist, or the babies delivered safely by foreign physicians, or the child who no longer suffers from malnutrition after his cleft palate repair, then these mission trips receive resounding support. If you ask the 50,000 patients seen each year at Albert Schweitzer hospital, one could assume they support his mission.

Only when you work in a setting where resources are more constrained than your own do you realize the vast amounts one can take for granted. We cancel cases if the temperature and humidity are not perfect, while many operating rooms have open windows, unreliable electricity and lack running water. Individual tourniquets used for each and every patient can be substituted by tying the same latex glove around the arms of the day’s patients. Disposable gowns, drapes and masks are reusable cloth in other settings. Some anesthesia providers have never seen an end-tidal carbon dioxide waveform, and some EKG monitors use tiny needle electrodes. Oxygen, air and suction are not piped through the walls of most facilities. In fact, medical air is largely unavailable. Astonishingly, so is medical oxygen.

Using industrial oxygen instead of medical-grade oxygen for hypoxemic patients, using tap water instead of distilled water for ventilator humidification systems, using an adult blood pressure cuff on a paediatric patient – these are real dilemmas faced daily by those working without the basic resources required for patient care.

Providers are forced to make choices between the ideal, the less than ideal and the unthinkable, to get patients through surgery and critical illness. Although tough choices often inspire innovation from which we all should learn, there are many occasions where patient safety is compromised. Learning to maintain a narrow balance is the goal for any anesthesiologist working when resources are constrained.

The accounts in this book give historical context, exploring equipment most have never seen, medications no longer available, and a time before vigilance for patient safety with standard monitoring. In addition to practical learning points, this book poses common ethical dilemmas still relevant in today's global health practice. How do you obtain informed consent with cultural awareness? What should be done to prevent the donated equipment graveyards? What can we learn from traditional medicine providers? Through thoughtful case discussions, readers are given fair warning that challenges always arise when working in new settings, but solutions are usually local. In rural practice, these dilemmas continue to arise, not only abroad, but in our own backyards. For the anesthesiologists working in remote areas with fewer resources, for the anesthesiologists providing clinical service in foreign environments, for any anesthesiologist about to embark on a mission trip, this book will provoke considerations you did not have previously. You will be more prepared.

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Map of Africa



African Countries Are Mentioned in Alphabetical Order in the Text

I am sure you will be surprised that there are 54 independent countries in Africa. There are also other countries outside of Africa that are mentioned in the case studies. They are included separately at the end. The information about all these countries includes its population, language and religion.

Africa

Algeria

Algeria is a North African country with a Mediterranean coastline and a Saharan desert interior. Many empires have left legacies here, such as the ancient Roman ruins in seaside Tipaza. In the capital, Algiers, Ottoman landmarks are seen from circa 1612. Population: 42 million. Official language Arabic. Religion: Islam.

Angola

Angola is a Southern African nation whose varied terrain encompasses tropical Atlantic beaches, a labyrinthine system of rivers and a Sub-Saharan desert that extends across its southern border into Namibia. The country's colonial history is reflected in its Portuguese-influenced cuisine and its landmarks including Fortaleza de São Miguel, a fortress built by the Portuguese in 1576 to defend the capital, Luanda. Population: 31 million. Official language: Portuguese – spoken by 80% of the population, but there are six other African languages spoken. Religion: Christian.

Benin

Benin is a French-speaking West African nation. It is a birthplace of the vodun (or “voodoo”) religion and home to the former Dahomey Kingdom from circa 1600–1900. In Abomey, Dahomey’s former capital, the Historical Museum occupies two royal palaces with bas-reliefs recounting the kingdom’s past and a throne mounted on human skulls. To the north, Pendjari National Park offers safaris with elephants, hippos and lions. Population: 12 million. Official language: French, but there are 55 national languages. Religion: 27.7% Muslim, 25.5% Roman Catholic, 13.5% Protestant, 11.6% Vodun, 9.5% of other Christian denominations and 12.2% of others or none.

Botswana

Botswana, a landlocked country in Southern Africa, has a landscape defined by the Kalahari Desert and the world-famous Okavango Delta. The latter becomes a lush animal habitat during the seasonal floods. The massive Central Kalahari Game Reserve, with its fossilized river valleys and undulating grasslands, is home to numerous animals including giraffes, cheetahs, hyenas and wild dogs. The capital is Gaborone. Population: 2.2 million. Official language: English. There are, however, 20 other languages spoken. Religion: Officially, Botswana is said to be a Christian country, although the number of practicing Christians is estimated at only around 20% of the population. Many people still maintain dual religious practices between Christianity and traditional religious worship.

Burkina Faso

Burkina Faso, officially the People’s Democratic Republic of *Burkina Faso*, is a small landlocked country in West Africa. A former French colony, it gained independence as Upper Volta in 1960. The name Burkina Faso, which means “Land of Incorruptible People,” was adopted in 1984. The capital Ouagadougou is in the centre of the country and lies about 500 miles (800 km) from the Atlantic Ocean. Population: 21 million. Religion: 50% of the population is Muslim. Official language is French but most people speak Mòoré and Fula as well as the African language.

Burundi

Burundi is a country in east-central Africa, south of the Equator. This landlocked country is one of the few countries in Africa whose borders were not determined by colonial rulers. The vast majority of Burundi’s population is Hutu, traditionally a farming

people. Power, however, has long rested with the Tutsi minority, which historically has controlled the army and most of the economy, particularly the lucrative international export of coffee. Few real cultural differences are distinguishable between the two peoples, and both speak Rundi (Kirundi). Population 11 million; 60% of the population is Roman Catholic; Official language is Rundi (Kirundi), a Bantu language that is the standard medium of communication throughout the country and French.

Cape Verde

Cabo Verde, also called Cape Verde, country comprises a group of islands that lie 385 miles (620 km) off the west coast of Africa. Praia on Santiago is the capital. The largest port in the islands is located at Mindelo on Sao Vicente. Its deepwater harbour accommodates sizable vessels and has been used as a fuelling station since the 19th century. Population: 550,000. Official language: Portuguese. Religion: 80% Roman Catholic

Cameroon

Cameroon, on the Atlantic, is a Central-West African country of varied terrain and wildlife. Its inland capital, Yaoundé, and its biggest city, the seaport Douala, are transit points to ecotourism sites as well as beach resorts like Kribi – near the Chutes de la Lobé waterfalls, which plunge directly into the sea. Population: 26.5 million. Official language: both English and French. Religion: 80% Christian.

Central African Republic (CAR)

The Central African Republic is a landlocked country in Central Africa. Armed groups continued to commit serious human rights abuses, expanding their control to an estimated 70% of the country, while the central government, led by President Faustin-Archange Touadéra, controlled the capital, Bangui. Population: 4.6 million. Official language: French and Sango. There are over 72 African languages. Religion: Christian 90%; Muslim 10%.

Chad

A largely semi-desert country, Chad is rich in gold and uranium and stands to benefit from its recently acquired status as an oil-exporting state. In 2003, it completion of a \$4bn pipeline linking its oilfields to terminals on the Atlantic coast. Chad's

post-independence history has been marked by instability and violence, stemming mostly from tension between the mainly Arab-Muslim and the predominantly Christian. Poverty is rife, and health and social conditions are poor. Population: 15.5 million. Official language: French and Arabic. Religion: 51.8% practicing Islam, 43.8% practicing some form of Christianity, and the remaining 4.4% being atheist. Within the Muslim community, 58% are Sunni, 11% are Shia, 4% are Ahmadi and 23% are nondenominational.

Comoros

The Comoros is a volcanic archipelago off Africa's east coast, in the warm Indian Ocean waters of the Mozambique Channel. The nation state's largest island, Grande Comore (Ngazidja), is ringed by beaches and old lava from the active Mt. Karthala volcano. Around the port and medina in the capital, Moroni, are carved doors and a white colonnaded mosque, the Ancienne Mosquée du Vendredi, recalling the islands' Arab heritage. Population: 850,000. Official Language: Comorian, French and Arabic. Religion: 98% are Sunni Muslims.

Congo, Democratic Republic of the Congo

The Democratic Republic of the Congo, also known as DR Congo, the DRC, DROC, Congo-Kinshasa or simply the Congo, is a country located in Central Africa. It was formerly called Zaire. It is, by area, the largest country in sub-Saharan Africa, the second-largest in all of Africa, and the 11th largest in the world. Population: 84 million. Official Language: French. Religion: Some three-fourths of the population is Christian. Adherents of Roman Catholicism account for about one-third of the country's Christians. The Protestant community includes members of the Evangelical Church of the Congo.

Congo, Republic of the Congo

The Republic of the Congo, also called Congo-Brazzaville, is a central African nation with rainforest reserves that are habitats for gorillas. Its capital city, Brazzaville, lies across the Congo River from Kinshasa, the capital of neighbouring Democratic Republic of the Congo. Brazzaville's highlights include traditional craft markets and the mid-20th-century Basilique Sainte-Anne, with a green-tiled roof and spire. Population: 5.6 million. Official language: French. Religion: Christian with 12% Muslims.

Cote d'Ivoire (Ivory Coast)

Côte d'Ivoire is a West African country with beach resorts, rainforests and a French-colonial legacy. Abidjan, on the Atlantic coast, is the country's major urban centre. Its modern landmarks include La Pyramide and St. Paul's Cathedral, a swooping structure tethered to a massive cross. North of the central business district is the Banco National Park, a rainforest preserve with hiking trails. Population: 25 million. Official Language: French. Religion: Islam 44 % and Christian 34 %. The rest follows traditional African religions.

Djibouti

Djibouti, on the Horn of Africa, is a mostly French- and Arabic-speaking country of dry scrublands, volcanic formations and Gulf of Aden beaches. It's home to one of the saltiest bodies of water in the world, the low-lying Lake Assal, in the Danakil Desert. The nomadic Afar people have settlements along Lake Abbe, a body of salt-water featuring chimney-like mineral formations. Population: 1 million. Official language: Arabic and French. Religion: 94% Sunni Muslims.

Egypt

Egypt, a country linking northeast Africa with the Middle East, dates to the time of the pharaohs. Millennia-old monuments sit along the fertile Nile River Valley, including Giza's colossal Pyramids and Great Sphinx as well as Luxor's hieroglyph-lined Karnak Temple and Valley of the Kings tombs. The capital, Cairo, is home to Ottoman landmarks like Muhammad Ali Mosque and the Egyptian Museum, a trove of antiquities. Population: 99 Million. Official language: Egypt-Arabic. Religion: Islam (Shia).

Equatorial Guinea

Equatorial Guinea is a Central African country comprising the Rio Muni mainland and 5 volcanic offshore islands. Capital Malabo, on Bioko Island, has Spanish colonial architecture and is a hub for the country's prosperous oil industry. Its Arena Blanca beach draws dry-season butterflies. The tropical forest of the mainland's Monte Alen National Park is home to gorillas, chimpanzees and elephants. Population: 1.4 million. Official language: French, Spanish and Portuguese Religion: Christian (90 %).

Eritrea

The Italians created the colony of Eritrea in the 19th century around Asmara and named it with its current name. After World War II, Eritrea was annexed to Ethiopia. In 1991, the Eritrean People's Liberation Front defeated the Ethiopian government. Population: 3.5 million. There is NO official language. English and Italian are also widely understood, but there are many Eritrea languages, like Tigrinya. Arabic and English predominate in commerce and national business. Religion: 60% Christian and 35% Islam.

Eswatini (formerly Swaziland)

Eswatini is a landlocked monarchy in Southern Africa. It is bordered by Mozambique to its northeast and South Africa to its north, west and south. It is one of the smallest countries in Africa. The population is 1.1 million and is composed primarily of ethnic Swazis. The language is Swazi, but most speak English. Religion: Traditional and Christian.

Ethiopia

Ethiopia, in the Horn of Africa, is a rugged, landlocked country split by the Great Rift Valley. Ethiopia is a predominantly agricultural country – more than 80% of the population lives in rural areas. With archaeological finds dating back more than 3 million years, it's a place of ancient culture. Among its important sites are Lalibela with its rock-cut Christian churches from the 12th to 13th centuries. Population: 115 million. Official language: Ethiopia has 83 different languages with up to 200 different dialects spoken. The largest ethnic and linguistic groups are the Oromos, Amharas and Tigrayans. Religion: Orthodox 43.5%, Muslim 33.9% and Protestant 18.5%.

Gabon

Gabon, a country along the Atlantic coast of Central Africa, has significant areas of protected parkland. The forested coastal terrain of its famed Loango National Park shelters a diversity of wildlife, from gorillas and hippos to whales. Lopé National Park consists of mostly rainforest. Akanda National Park is known for its mangroves and tidal beaches. It was to this country Dr. Albert Schweitzer settled in 1913. He wrote the book called: "Reverence for life", for which he received the

1952 Nobel Peace Prize. Actually, I (JGBU) was a little boy seeing him, in on the balcony of the City Hall, in Oslo when he got the Peace Prize. What an example he was to us all. Population: 2.1 million. Official language: French. Religion: Roman Catholics account for about two-fifths.

Gambia

Gambia is a small West African country, bounded by Senegal, with a narrow Atlantic coastline. It's known for its diverse ecosystems around the central Gambia River. Abundant wildlife in its Kiang West National Park and Bao Bolong Wetland Reserve includes monkeys, leopards, hippos, hyenas and rare birds. The capital, Banjul, and nearby Serrekunda offer access to beaches. Population: 2.2 million. Official language: English. Religion: Muslim 90%.

Ghana

Ghana (Warrior King) is a country located along the Gulf of Guinea an Atlantic Ocean in West Africa. The first permanent state in the territory of present-day Ghana dates back to the 11th century. Beginning in the 15th century, the Portuguese Empire, followed by numerous other European powers, before the British ultimately established control of the coast by the late 19th century. Ghana became independent in 1957, Population: 30 million. Official language: English. Religion: Christian 70%.

Guinea-Bissau

Guinea-Bissau is a tropical country on West Africa's Atlantic coast that's known for national parks and wildlife. The forested, sparsely populated Bijagós archipelago is a protected biosphere reserve. Its main island, Bubaque, forms part of the Orango Islands National Park, a habitat for saltwater hippos. On the mainland, the capital, Bissau, is a port with Portuguese colonial buildings in its old city centre. Population: 1.8 million. Official language: Portuguese. Religion: Christian.

Ivory Coast

In 1960 France granted independence under President Felix Houphouet-Boigny. He held power until he died in 1993. From 2002 to 2007, Civil war effectively splits the country into Muslim rebel-held north and government-controlled Christian south.

Post-election 2010, left 3,000 people dead and 500,000 displaced. In 2016 Al-Qaeda jihadists attack the beach resort of Grand Bassam, near Abidjan, killing 18 people. Population: 25 million. Official language: French. Religion: Islam, Christian and indigenes beliefs.

Kenya

Kenya is a country in East Africa with coastline on the Indian Ocean. It encompasses savannah, lakelands, the dramatic Great Rift Valley and mountain highlands. It's also home to wildlife like lions, elephants and rhinos. From Nairobi, the capital, many National Parks can be accessed. From many, you can view Tanzania's 5,895 metre Mt. Kilimanjaro. Population: 51 million. Official language: Swahili and English. Religion: Christian 85% and Islam 10%.

Lesotho

Lesotho, a high-altitude, landlocked kingdom encircled by South Africa, is criss-crossed by a network of rivers and mountain ranges including the 3,482 metre high peak of Thabana Ntlenyana. On the Thaba Bosiu plateau, near Lesotho's capital, Maseru, are ruins dating from the 19th-century reign of King Moshoeshoe I. Thaba Bosiu overlooks iconic Mount Qiloane, an enduring symbol of the nation's Basotho people. Population: 2.1 million. Official language: Sesotho and English. Religion: Christian 90%.

Liberia

Liberia is a country in West Africa, bordering Sierra Leone, Guinea and Côte d'Ivoire. To the west is the Atlantic coast. Here you find the capital city of Monrovia (named after the US President Monroe). In the city is the Liberia National Museum, with its exhibits on national culture and history Liberia was founded by free people of colour from the United States. They created the American Colonization Society (ACS). In 1847, the ACS encouraged Liberia to declare independence, as the organization could no longer support the colony against territorial incursions by the neighboring British and French. The United States declined to act on requests from the ACS to make Liberia an American colony or to establish a formal protectorate over Liberia, but it did exercise a "moral protectorate" over Liberia, intervening when European powers threatened its territory or sovereignty. The Republic of

Liberia was created on July 26, 1847. The Virginia-born Joseph Jenkins Roberts was the nation's first president. Population: 4.8 million. Official language: English. Religion: Christian 85%.

Libya

Libya, officially the State of Libya, is a country in the Maghreb region in North Africa, bordered by the Mediterranean Sea to the north, Egypt to the east, Sudan to the southeast, Chad to the south. Since 2015 a second civil broke out, with parts of Libya split between the Tobruk and Tripoli-based governments, as well as various tribal and Islamist militias. Population: 6.7 million. Official language: Arabic. Religion: Islam with 97% Sunni.

Madagascar

Madagascar is the world second largest island in the world in the Indian Ocean. It is the biggest producer of vanilla in the world. It is approximately 400 km off the coast of East Africa. Population: 27 million. Official language: Malagasy and French. Religion: Christian 41% and Islam 7%.

Malawi

Malawi, a landlocked country in southeastern Africa, is defined by its topography of highlands split by the Great Rift Valley and enormous Lake Malawi. The lake's southern end falls within Lake Malawi National Park – sheltering diverse wildlife from colourful fish to baboons – and its clear waters are popular for diving and boating. Population: 18.1 million. Official language: English. Religion Christian: 77% and Islam 15%.

Mali

Mali, officially the Republic of Mali, is a landlocked country in West Africa. Mali is the eighth-largest country in Africa, with an area of just over 1,240,000 square kilometres. The population of Mali is 19.1 million. 67% of its population was estimated to be under the age of 25 in 2017. Its capital is Bamako. Official language: French. Religion: Islam 95%.

Mauritania

Mauritania is an Islamic in Northwest Africa. It is the eleventh largest sovereign state in Africa and is bordered by the Atlantic Ocean to the west. Population: 4.4 million. Official language: French. Religion: Islam 100%.

Mauritius

Mauritius, an Indian Ocean island nation, is known for its beaches, lagoons and reefs. The mountainous interior includes Black River Gorges National Park, with rainforests, waterfalls, hiking trails and wildlife like the flying fox. Population: 1.2 million. Official language: Creole 84%. Religion: Hindu 50%, Christian 33% and Islam 16%.

Morocco

Morocco is a North African country bordering the Atlantic Ocean and the Mediterranean Sea. It is distinguished by its Berber, Arabian and European cultural influences. Casablanca is the largest city. Population: 36 million. Official language: Arabic. Religion: Islam 73 %.

Mozambique

Mozambique is a southern African nation whose long Indian Ocean coastline is dotted with beaches and offshore marine parks. The fishing is incredible as landmines have prevented fishing from the beaches. In the Quirimbas Archipelago, a 250 km stretch of coral islands, mangrove-covered Ibo Island has colonial-era ruins surviving from a period of Portuguese rule. Population: 29.5 million. Official language: Portuguese. Religion: Christian 58% and Islam 19%.

Namibia

Namibia is a country in southwest Africa and is distinguished by the Namib Desert along its Atlantic Ocean coast. The country is home to diverse wildlife, including a significant cheetah population. The capital, Windhoek, and coastal town Swakopmund

contain German colonial-era buildings such as Windhoek's Christuskirche, built in 1907. In the north, Etosha National Park's salt pan draws game including rhinos and giraffes. Population: 2.5 million. Official language: English. Religion: Christian 90%.

Niger

Niger is a landlocked country in West Africa named after the Niger River. Population: 22.4 million. Official language: French. Religion: Islam.

Nigeria

Nigeria is an African country on the Gulf of Guinea and has many natural landmarks and wildlife reserves. Protected areas such as Cross River National Park and Yankari National Park have waterfalls, dense rainforest, savanna and rare primate habitats. One of the most recognizable sites is Zuma Rock, a 725 m-tall monolith outside the capital of Abuja that's pictured on the national currency. Population: 195 million. Official language: English. Religion: Christianity, Islam and African Traditional Religion (ATR).

Rwanda

Rwanda, formerly Ruanda, officially the Republic of Rwanda, is a landlocked country in the Great Rift Valley where the African Great Lakes region and East Africa converge. One of the smallest countries on the African mainland, its capital city is Kigali. Population: 12 million. Official languages: Kinyarwanda, French, English and Swahili. Religion: Christian 95%.

Sao Tome and Principe

São Tomé and Príncipe, an African island nation, close to the equator in the Atlantic. It is part of a volcano chain featuring striking rock and coral formations, rainforests and beaches. On the larger island, São Tomé, is the Lagoa Azul lagoon. Ôbo Natural Park, a biodiverse jungle preserve, covers much of São Tomé and is distinguished by Pico Cão Grande, a skyscraperlike volcanic rock. Population: 211,000. Official language: Portuguese. Religion: Christian 95%.

Senegal

Senegal, officially the Republic of Senegal, is a country in West Africa which is on the Atlantic Ocean. Senegal is bordered by Mauritania in the north, Mali to the east, Guinea to the southeast and Guinea-Bissau to the southwest. Population: 15.1 million. Official language: French. Religion: Islam 96%.

Seychelles

The Seychelles is an archipelago of 115 islands in the Indian Ocean, off East Africa. It is home to numerous beaches, coral reefs and nature reserves, as well as rare animals such as giant Aldabra tortoises. Mahé, a hub for visiting the other islands, is home to capital Victoria. It also has the mountain rainforests of Morne Seychellois National Park and beaches. Population: 97,000. Official language: French, Seselwa and English. Religion: Christian 82%.

Sierra Leone

Sierra Leone is a country in West Africa, on the Atlantic Ocean. It's known for the white-sand beaches lining the Freetown Peninsula. The capital city, Freetown, commemorates the nation's slave-trade history with the Cotton Tree landmark and King's Yard Gate. Both were known as places of refuge for returned slaves in the 18th and 19th centuries. Nearby Bunce Island was a key departure point during the slave trade. Population: 7.6 million. Official language: English. Religion: Islam 77% and Christian 21%.

Somalia

Somalia, officially the Federal Republic of Somalia, is a sovereign country located in the Horn of Africa. It is bordered by Ethiopia to the west, the Gulf of Aden to the north, the Guardafui Channel and Somali Sea to the east, and Kenya to the southwest. Population: 15 million. Official language: Somali. Religion: Islam

South Africa

South Africa is a country on the southernmost tip of the African continent, marked by several distinct ecosystems. Inland safari destination Kruger National Park (the first designated National park in the world) is populated by big game. The Western

Cape offers beaches, lush winelands around Stellenbosch and Paarl, craggy cliffs at the Cape of Good Hope, forest and lagoons along the Garden Route, and the city of Cape Town, beneath flat-topped Table Mountain. Natal in the east along the Indian Ocean with the largest city Durban is the home to 12 million Zulus. Population: 58 million. Official language: Afrikaans, English, Zulu, Xhosa, Venda, Southern Sotho, Tswana, Tsonga, Northern Sotho, Swati and Ndebele. Religion: Christian 80%.

South Sudan

South Sudan is known as the Republic of South Sudan and is a landlocked country in East-Central Africa. It is bordered to the east by Ethiopia to the north by Sudan, to the west by the Central African Republic, to the south-west by the Democratic Republic of Congo, to the south by Uganda and to the south east by Kenya. It gained independence from the Republic of Sudan in 2011, Population: 11 million. Official language: English. Religion: No official religion but the majority are Christian.

Sudan

Sudan, officially the Republic of Sudan, is a country in Northeast Africa. Bordered by Egypt to the north, Libya to the northwest, Chad to the west and the Red Sea to the northeast. Population: 42 million. Official language: Arabic and English. Religion: Islam (majority Sunni).

Tanzania

Tanzania is an East African country known for its vast wilderness areas. They include the plains of Serengeti National Park, a safari mecca populated by the “big five” game (elephant, lion, leopard, buffalo and rhino) and Kilimanjaro National Park, home to Africa’s highest mountain. Offshore lie the tropical islands of Zanzibar, with Arabic influences, and Mafia, with a marine park home to whale sharks and coral reefs. Population 56: million. Official language: Swahili and English. Religion: Majority is Islam.

Togo

Togo, a West African nation on the Gulf of Guinea, is known for its palm-lined beaches and hilltop villages. Koutammakou, inhabited by the Batammariba people, is a traditional settlement of fortress-like clay huts dating to the 17th century. In the

capital, Lomé, are the multistory Grand Marché bazaar and the Fetish Market, offering traditional talismans and remedies relating to the vodun (voodoo) religion. Togo is one of the smallest country in Africa. Population: 8 million. Official language: Non, but 44 languages are recorded. Religion: Christian 44%, Traditional 37 % and Islam 14%.

Tunisia

Tunisia is a North African country bordering the Mediterranean Sea to the north and the Sahara Desert to the south. In the capital, Tunis, the Bardo Museum has archaeological exhibits from Roman mosaics to Islamic art. The city's medina quarter encompasses the massive Al-Zaytuna Mosque and a thriving souk. To the east, the site of ancient Carthage features the Antonine Baths. Population: 12 million. Official language: Arabic. Religion: Islam (majority is Sunni).

Uganda

Uganda is a landlocked country in East Africa whose diverse landscape encompasses the snow-capped Rwenzori Mountains and immense Lake Victoria. Its abundant wildlife includes chimpanzees as well as rare birds. Remote Bwindi Impenetrable National Park is a renowned mountain gorilla sanctuary. Murchison Falls National Park in the northwest is known for its tall waterfalls and wildlife such as hippos. Population: 43 million. Official language: Swahili and English. Religion: Christian 75%.

Western Sahara

Western Sahara is a disputed territory on the northwest coast and in the Maghreb region of North and West Africa. About 20% of the territory is controlled by the self-proclaimed Sahrawi Arab Democratic Republic, while the remaining 80% of the territory is occupied and administered by neighboring Morocco. Population: 273,000. Official language: Arabic Religion: Islam.

Zambia

Zambia, in southern Africa, is a landlocked country of rugged terrain and diverse wildlife, with many parks and safari areas. On its border with Zimbabwe is the famed Victoria Falls – indigenously called Mosi-oa-Tunya, or “Smoke That Thunders” – plunging a misty 108 m into a narrow Batoka Gorge. Spanning the

Zambezi River just below the falls is Victoria Falls Bridge, a spectacular viewpoint. Population: 17 million. Official language: English. Religion: Christian.

Zimbabwe

Zimbabwe is a landlocked country in southern Africa known for its dramatic landscape and diverse wildlife, much of it within parks, reserves and safari areas. On the Zambezi River, Victoria Falls make a thundering 108 m drop into narrow Batoka Gorge, where there's white-water rafting and bungee-jumping. Downstream are Matusadona and Mana Pools national parks, home to hippos, rhinos and birdlife. Population: 15 million. Official languages: English, Shona, Xhosa, Tsonga and several others. Religion: Christian.

Other Countries Outside of Africa Mentioned Are Follows

Bangladesh

Bangladesh, to the east of India on the Bay of Bengal, is a South Asian country marked by lush greenery and many waterways. Its Padma (Ganges), Meghna and Jamuna rivers create fertile plains, and travel by boat is common. On the southern coast, the Sundarbans, an enormous mangrove forest shared with Eastern India, is the home to the royal Bengal tiger. Population: 161 million. Official language: Bengali. Religion: Islam 90%.

Borneo

Borneo, a giant, rugged island in Southeast Asia's Malay Archipelago, is shared by the Malaysian states of Sabah and Sarawak, Indonesian Kalimantan and the tiny nation of Brunei. It's known for its beaches and ancient, biodiverse rainforest, home to wildlife including orangutans and clouded leopards. In Sabah is 4,095 m tall Mount Kinabalu, the island's highest peak, and, offshore, the famed dive site Sipadan Island. Population: 21 million. Official language: Bahasa Malaysia. Religion: Islam 60%, Buddhist 19%, Christian 9% and Hindu 6%.

Colombia

Colombia has significant natural resources and its culture reflects the indigenous Indian, Spanish and African origins of its people. It has been ravaged by a decades-long violent conflict involving outlawed armed groups, drug cartels and gross

violations of human rights. It is the fourth largest country in South America and one of the continent's most populous nations. Colombia has substantial oil reserves and is a major producer of gold, silver, emeralds, platinum and coal. Population: 50 million. Official language: Spanish. Religion: Roman Catholic.

Costa Rica

Costa Rica is a rugged, rain-forested Central American country with coastlines on the Caribbean and Pacific. Though its capital, San Jose, is home to cultural institutions like the Pre-Columbian Gold Museum, Costa Rica is known for its beaches, volcanoes and biodiversity. Roughly a quarter of its area is made up of protected jungle, teeming with wildlife including spider monkeys and quetzal birds. Population: 5 million. Official Language: Spanish. Religion: Christian.

Guyana

Guyana, officially the Co-operative Republic of Guyana, is a country on the northern mainland of South America. It is considered part of the Caribbean region because of its strong cultural, historical and political ties with other Anglo-Caribbean countries. Guyana is bordered by the Atlantic Ocean to the north, Brazil to the south and southwest, Venezuela to the west and Suriname to the east. Guyana is the third-smallest sovereign state on mainland South America after Uruguay and Suriname. Guyana is the only South American nation in which English is the official language. The majority of the population, however, speak Guyanese Creole, an English-based creole language as a first language. Guyana was settled by the Dutch before coming under British control in the late 18th century. It was governed as British Guiana with a mostly plantation-style economy until the 1950s. However, in 2015 Exxon-Mobile found a large amount of oil and gas in the sea outside of Georgetown, the capital. Population: 780,000. Official language: English. Religion: Christian 64 %, Hindu 24.8 %, Muslim 6.8% and Jehovah's Witness 1.3%.

India

India, officially the Republic of India, is a country in South Asia. The Mughal Empire, in 1526, provided two centuries of relative peace, leaving a legacy of luminous architecture like the Taj Mahal. Gradually expanding the rule of the British East India Company followed, turning India into a colonial economy. British Crown rule commenced in 1858. Indians were granted sovereignty in 1950 with the

division of India and Pakistan. India is the second-most populous country in the world and the seventh-largest country by area. It is also the most populous democracy in the world with a population 1.4 billion. Official language: Hindi and English. Religion: Hindi 80%, Islam 14%, Christian 2.3% and Sikhism 1.7%.

Nepal

Nepal, officially the Federal Democratic Republic of Nepal, is a country in South Asia. It is located mainly in the Himalayas but also includes parts of the Indo-Gangetic Plain. It is landlocked and borders China in the north and India in the south, east and west. Population: 33 million. Official language: Nepali. Religion: Hindi.

Peru

Peru is a country in South America that is home to a section of Amazon rainforest and Machu Picchu, an ancient Incan city high in the Andes mountains. The region around Machu Picchu, including the Sacred Valley, Inca Trail and colonial city of Cusco, is rich in archaeological sites. On Peru's arid Pacific coast is Lima, the capital, with a preserved colonial centre and important collections of pre-Columbian art. Population: 33 million. Official language: Spanish. Religion: Christian.

Sri Lanka

Sri Lanka, formerly Ceylon, is a country on an island in the Indian Ocean and separated from peninsular India by the Palk Strait. It has a maximum length of 268 miles (432 km) and a maximum width of 139 miles (224 km). Population: 22 million. Official language: Sinhala, while Tamil shall also be an official language. English is a link language. Religion: 70.2% Theravada Buddhists, Hindus 12.6%, Islam 9.7% (mainly Sunni) and Roman Catholic 6.1%.

Syria

Syria, officially the Syrian Arab Republic, is a country in Western Asia, bordering Lebanon to the southwest, the Mediterranean Sea to the west, Turkey to the north, Iraq to the east. Population: 16 million. Language: Arabic. Religion: Islam 87% (majority Sunni (74%).

Turkey

Turkey, officially the Republic of Turkey, is a transcontinental country located mainly on the Anatolian peninsula in Western Asia, with a smaller portion on the Balkan peninsula in Southeastern Europe. Population: 88 million. Official language: Turkish. Religion: Islam 60%.

Acknowledgements

To my wife, Sue, for her constant encouragement and understanding as a physician's wife. Without her I doubt very much I would have spent 17 wonderful years in Africa. Her help with proofreading has been invaluable.

To Jon Gjessing, MD, PhD (originally from Sundsvall, Sweden); Arne Oesterud, MD, PhD; and Lorents Gran, MD, PhD, all of Rikshospitalet, Oslo, Norway for starting me on my academic path.

To John W. Downing, MD, Professor and Head of Department of Anesthetics, University Natal Medical School, Durban, South Africa for his guidance, friendship and wisdom during my time in Durban and beyond.

To Ana Crawford, MD, for being so gracious in agreeing to write the foreword for this book.

To my secretary Carolyn, the best secretary anyone can have. Her willingness and her attention to detail are of the highest order.

To Greg Sutorius and Eugenia Judson of Springer, for always being available for questions and concerns.

I am indebted to the following, whom I have worked with during my sojourn in Africa and the Far East. I thank them for their camaraderie and outstanding contribution to the population they served.

Miriam Adhikari, Peter John Allan, John Atchison, Andrew Andrews, Nasima Badsha, Brian Baker, Andy J. Barclay, Rosie Barclay, Jeff Barwise, Gordon Blake, David Blight, Paul Blignaut, Adrian (Bosie) Bosenberg, Erin Botha, Robert Buley, Ross Bullock, Richard (Dick) Burrows, Pat Callander, Jerry Coovadia, Chris Cuerden, Peter Desmaris, George Dimopoulos, Tom Dow, John W. Downing, Richard Dunning, Johan DuPreez, Inga Elson, Herbert Engelbrecht, Paul Fairbrother, Vladimir Firago, Louise Fourie, Stephen L. Gaffin, Premjith Gathiram, Alexandro Gavaze, Jon Gjessing, Michael Grant, Christopher Good, Allan Gorven, Neal Goodwin, Lorentz Gran, Ronald Green-Thompson, Mike Gregory, Gordon Haddow, Ariff Ahmed Haffejee, John Hamilton, Rex Henderson, Bruce Henderson, John Hicks, Allan Hold, Alison Holloway, William Huizinga, David Humphrey, Mike James, David Jeal, Brother John, Derek G. Jordaan, John Jordaan, Ahmed (Mahmood) Kadwa, Soromini Kallichurum, Sunder Roopsun Kambaran, Komal

Kamra, Mary Khaing, Muhammad Fazl-Ur Rahman Khan, Harry Kingston, Yvonne Koen, Ben Le Roux, Andrew Logan, Andrew Love, Paul G. Lukin, Robin MacGillvray, Rob MacKenzie, TA MacPherson, Rajend Maharaj, Nisha Malhotra, Emmanuel (“Mannie”) Mankowitz, Masizane Marivate, Maurice Mars, Aileen Marszalek, Nasim Mayat, Robin McAravey, Larry McFadden, Ashley Micks, Robert (Bob) Mickel, Jack Moodley, David Morrell, Mike Moshal, Ali Mossa, Don Moyes, Glen Moffett, Khobi Msimang, Radha Muthukumarasamy, Rai Naidu, Clint Naiker, Sim Naicker, Birgit Niestroj, James Nixon, Andy Norbury, John Odell, Stephen O’Keefe, Alicja Orkiszewski, Tim Pavy, Sherman Ripley, Dennis Pudifin, Deshandra Raidoo, Jerry Readie, John Redpath, John Robbs, Tony Rocke, Mike Rogers, Chris Rout, Joe Rubin, Tom Ruttman, Robert Salisbury, Inga Schwegmann, Nigel Schodel, Soraya Seedat, Dione Somerville, Julian Somerville, Ted Sommerville, Jean Marie Spitaels, Robin Stiebel, Marie Strassburg, James Van Dellen, Johan Van den Ende, Herman van der Heyden, Hoosen M. Vawda, BJ Vorster, Hendrik J. Vreman, Michelle Wells, Steve Welman, Nigel Welsh, Brian Wessels, Ron Williamson, Gail Wilmot, Tim Winning, and Amadeo Zanotti.

Prologue

*Two roads diverged in a wood, and I –
I took the one less traveled by,
And that has made all the difference*

Robert Frost (1874–1963)

From as far back as I can remember, I have wanted to travel. Perhaps that desire was sparked by my Norwegian Viking blood. When I was considering a medical specialty, one of the deciding factors for choosing anesthesiology was that it would allow me the opportunity to travel and to work throughout the world. Fortunately for me, my desire to see the world became a reality and I ended up working on three continents, including 17 years in South Africa.

Many anesthesiologists find that going on a 1–2 weeks medical missions to low-resource settings is very rewarding. The trip organizers recruit their own team and send all the required surgical and anesthesia equipment. The only resources provided by the small hospital you work at are the operating room(s), oxygen, electricity and perhaps nitrous oxide. Modern equipment and monitors that are brought in ensure safe surgery and anesthesia. This makes the anesthesia experience similar to the standards set at home.

The case studies in this book do not describe 1–2-week sojourns. They describe the life of an anesthesiologist when he/she immerses himself/herself for a long period of time, months, even years, in low-resource settings. It's an entirely different experience from a short medical mission. A few modern machines or equipment are available. Instead, you will find hospitals that are sorely underfunded. They consist of low cinder-block buildings which are often surrounded by a tall security wall. Within the compound are neatly spaced barracks, and inside each you will find row after row of metal-framed beds spaced about two feet apart. If the hospital is busy and overcrowded, you may even find patients being housed underneath the beds. There are no private rooms and usually no curtains for privacy. The electricity will be intermittent at best since the hospitals often do not have money to pay for fuel to keep their generators running 24/7. Rarely is there air-conditioning. If you are lucky there may be ceiling fans, which will stop working when the power cuts

out. The heat can be oppressive, and it exaggerates the ever-present odor of sweat and antiseptic. In addition to these challenges, the anesthesiologist often works alone with old and/or foreign equipment and manages patients with strange unfamiliar diseases, often using outdated drugs.

When you arrive for the first time at one of these low-resource settings, you may have little practical knowledge of the exotic illnesses among the local inhabitants or their culture and beliefs. Adding to the challenge, you probably won't speak the local language and the patients and nurses probably will not speak your language. Hence, administering an anesthetic can be tricky for anyone who has not been trained in such an environment. I discovered all this when I first arrived in South Africa in 1971.

In this book, please note that I have named the country where the described case occurred. It may be in Africa, Asia, Latin or South America. To be clear, I have not been nor have I worked in many of the countries that are mentioned. The stories do represent actual cases/problems I collected from my own experiences and from those of my friends. I have included them to show the variety of different challenges (diseases, drugs, etc.) that may be encountered when working in these locations.

In front of the book, you will find a map of Africa. There is also, in alphabetical order, a list of each country mentioned and a short description of these countries, the population size, major religions practiced and the languages that are spoken. You may be surprised to learn that there are 54 independent and separate countries located on the African continent.

The medical staff that provide care at the hospitals/clinics are outstanding people, who work under the most difficult conditions, with little or no funding. We can only admire them for their fortitude and empathy for their fellow men. To me, these hospitals are like a beacon of hope in an otherwise difficult/dangerous world.

The book tries to outline problems, through case studies that you may encounter in low-resource settings, even for a short visit. My hope is that the book will prepare you with a better understanding of the types of problems you can expect to face.

The work may sound daunting. However, should you embark on such an adventure, I can guarantee it will be a most memorable, rewarding experience. In fact, I would be very surprised if it did not turn out to be one of the happiest periods of your working life.

It certainly was for me.

I don't know what your destiny will be,
but the one thing I know:
the ones among you who will be really happy are those who have
sought and found how to serve.

Albert Schweitzer 1875–1965

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