

Meeting the Need: Nyaya Health's Expanded Service Plan
Constructing Essential Surgical and Inpatient Care Facilities

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Executive Summary

Nyaya Health is a registered 501(c)(3) non-profit organization working with communities in Nepal and with the Nepali Ministry of Health to develop healthcare services in the poor, western regions of the country. The district of Achham is a rural agricultural area with some of Asia's highest poverty, infant mortality, maternal mortality, and HIV incidence rates. Our mission in Achham is two-fold: to establish essential public health services in one of the world's most underdeveloped areas, and to develop a model program that establishes how to scale-up and manage comprehensive healthcare services in remote, resource-deprived areas.

Relevant statistics of the district

- Number of citizens: 250,000
- Number of doctors (excluding Nyaya Health): 1 (located 5 hours from the clinic)
- Number of ultrasound machines: 0 (none in an area covering over 1 million people)
- 99.5% of babies are delivered outside a health center
- 1 in 125 deliveries result in death of the mother
- 60% of children are chronically malnourished
- Average person makes \$150 a year
- Over 50% of the men migrate to India in search of work
- Over 7% of the men returning from Mumbai are HIV-positive
- Nearest functioning airport and hospital: 10 hours by bus, costs 1 month's average income

Present Activities

The heart of Nyaya Health activities in Achham is a four-bed, five-room clinic focusing on primary care, maternal and child health, HIV, and tuberculosis. Our clinic is run by [an all-Nepali staff](#) consisting of a physician, community healthcare workers, midwives, lab technicians, and project managers. We are expanding a [network of community health](#) workers who provide essential outreach and triage services to our geographically dispersed population. These services have been developed in collaboration with the government of Nepal; our ultimate goal is full integration of our services with the developing public-sector health program. Over the next year, we are constructing a community telemedicine center, applying [information and communication technologies](#) in innovative ways to improve the effectiveness and equity of our health services. We are developing innovative [management programs](#) to improve our community ownership, accountability and responsiveness. Additionally, we are exploring mechanisms of sustainable, accountable financing through [microfinance and community-based insurance](#). Our long-term vision is to work with local communities as part of a global healthcare movement that: (1) facilitates resource distribution to resource-denied areas; (2) fosters grassroots collective action; (3) involves the central government in pro-poor health infrastructure; and (4) achieves transparency and collaboration in global health delivery.



Nyaya Health Sanfe Bagar Clinic

Scope and Rationale

Through our experiences caring for the community in Achham, and through our discussion with the local community and government, it has become clear that essential inpatient and surgical services must be provided to make a significant and comprehensive public health impact in the region. The maternal health situation is particularly dire in this area, with best estimates indicating that a pregnant woman is 100 times more likely to die in childbirth in Achham (nearly one in 100 pregnancies) than in the United States. The high maternal mortality rate, coupled with the lack of essential health delivery infrastructure, has been our primary motivation for working in the region. We have begun to address the lack of infrastructure through our primary care clinic, staffed by an all-Nepali team of healthcare professionals. The clinic currently provides care to approximately 60 patients a day and includes 24-hour labor and delivery services. We are rapidly reaching capacity, however, and will expand in a timely and responsible manner to meet the growing need for both healthcare delivery services, and the training of new Nepali healthcare workers.

Local citizens and government officials have offered to us an abandoned hospital near to our current clinic to renovate and deploy essential inpatient and surgical services, as well as training programs. In keeping with the model we have developed at our clinic, the expansion to provide these services will complement general primary care and serve as a community-driven initiative to provide training, sustainable infrastructure, and high-quality medical standards for service delivery in the region. This will involve the following key actions, listed in the order of their planned implementation:

- renovating the abandoned government hospital in the neighboring village of Bayalpata;
- expanding primary care, normal delivery services, and community health worker programs to the hospital;
- deploying diagnostic ultrasound (currently unavailable for a region of approximately one million people);
- establishing X-Ray services;
- building a 14-bed inpatient ward to support our existing 24-hour maternal services;
- establishing blood transfusion capacity;
- expanding our existing high-quality laboratory services, including culture microbiology;
- developing a surgical team capable of delivering essential surgical services including Cesarean sections, appendectomies, and basic orthopedic procedures. This team would be led by a generalist Nepali physician trained through the national MD-GP (general practitioner) program.

To achieve our objectives, we have created a step-wise plan of implementation and assigned project directors to oversee these steps. We have detailed the protocols and procedures that will be followed during the construction and expansion of services, produced contingency plans in the event of potential obstacles, and crafted an efficient but comprehensive budget for this initiative.



View of the Abandoned Bayalpata Hospital Complex

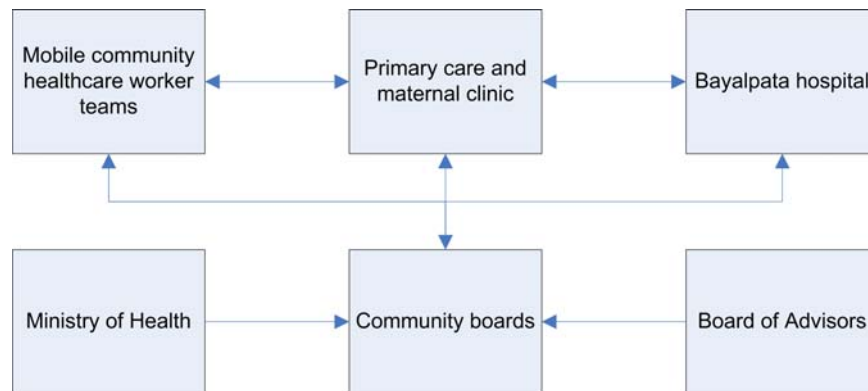
Overall Mission

We will be raising \$580,000 from our own fundraising campaign, which--together with resources from the government and in-kind donations of medical equipment--will provide the initial capital and 3 years of operating costs needed to fund these services. A plan involving gradual training and integration with the new parliamentary government's universal care initiative is also included, for long-term sustainability of the initiative as a community public health enterprise, after Nyaya Health establishes the protocols, system of delivery, and training programs. Throughout the implementation process, we will follow Nyaya Health's responsible approach to health infrastructure development:

- *Facilitating resource distribution to resource-denied areas.*
We will continue to utilize our expanding grassroots social network that is procuring finances and equipment to develop models for resource distribution to one of the most impoverished areas of Nepal. This work provides a necessary injection of critical resources for local communities to provide services, maintain and expand training programs, and begin to believe in their right to excellent health and their ability to achieve it. Expatriate staff members provide technical expertise, training and assistance in clinic oversight, but do not receive any financial compensation. Nearly 100% of our grant funding goes towards the salaries of Nepali staff, supplies, pharmaceuticals, and other direct health service costs.
- *Fostering grassroots collective action to improve local ownership over healthcare.*
The local community members and district health officials have been advocating for the expansion of the very popular Nyaya Health services. Local community members will take ownership over the health services through the expansion of our existing local management structures. We will continue to employ a diverse all-Nepali staff from all socioeconomic and caste backgrounds. We will expand local investment in healthcare through community-based health insurance and microfinance programs.
- *Involving the central government in pro-poor health infrastructure.*
We believe that the government is ultimately responsible for providing healthcare to its citizens. The Ministry of Health is providing essential medicines for maternal and child health, HIV, and tuberculosis. The government has also agreed to provide us the abandoned hospital. We are currently finalizing the timetable for them to provide additional supplies and staffing, and ultimately take fiscal and operational control of the facility after we establish service protocols and provide operational oversight.
- *Achieving transparency and collaboration in global health delivery*
As an open-source and transparent organization, we make all of our planning documents, costing tools, and clinical protocols available online for free download to the public (www.nyayahealth.org).

Timeline for the Roll-Out of Services			
Activity	2009	2010	2011
Community Dialogue and Mobilization			
Government negotiations			
Site planning			
Renovations			
Expansion of community health network			
Enhanced primary care services			
Delivery Services			
Ultrasound			
X-Ray			
Inpatient Services			
Blood Transfusion			
Expanded Laboratory Services			
Surgical Services			
Fundraising Targets	\$226,059	\$177,701	\$174,381

Organizational structure



Collaborators

Ministry of Health

- Pharmaceutical supply
- Medical equipment
- Staffing
- Integration with other public sector services
- Long-term ownership

Nyaya Health

- Managerial oversight
- Large items
- Financial support
- Medical equipment donations
- Technical assistance
- Service Delivery Innovations

Community boards and leaders

- Ethical oversight
- Accountability to local citizens
- Grassroots Advocacy
- Financial support

Services Delivered

Community health worker network

- Point-of-care treatment and referral
- Outreach to marginalized communities
- Local-level advocacy
- Preventive medicine delivery
- Antenatal care delivery

Primary care and maternity clinic

- Conducting normal deliveries
- Provision of primary and emergency care
- Treatment of pediatric conditions
- Training of community health workers
- Referral center for community health workers' patients

Bayalpata Hospital

- Management of complicated pregnancy
- Surgical services
- Blood transfusion
- Training of health workers and clinic staff



Nyaya Health midwife performing intake

Overview

Nyaya Health Activities

Nyaya Health is registered with the Social Welfare Council of Nepal and has an agreement with the Nepal Ministry of Health and Population to provide medical services in the Achham district of Far Western Nepal. In collaboration with the District Health Office of Achham, Nyaya Health operates a primary care center with an all-Nepali staff, including a physician, two health assistants, a pharmacist, four auxiliary nurse midwives, a laboratory technician, and several community healthcare workers. The clinic is located in Sanfe Bagar, a major transit hub for migrants from Achham and the northern districts. Clinical services have focused on addressing the major needs of our population: general primary care, maternal and child health, and HIV and tuberculosis prevention and treatment. We are also expanding a network of community health workers who provide essential outreach and triage services to a geographically-dispersed population.

Presently, the Sanfe Bagar clinic treats just over 60 patients per day, and is quickly reaching its capacity. The healthcare problems of the region are severe, with the patients we see typically in dire need of health services. Community members, government officials, clinic staff, and patients are all advocating that we rapidly, efficiently, and effectively expand our high-quality services to include inpatient and surgical capacity, given the extensive need in the area.



Sanfe Bagar Medical Clinic Delivery Suite

Health and Development in Achham

Achham is one of the poorest districts in Nepal. Annual income averages less than US\$0.40/day, and 95% of homes lack electricity. A staggering 60% of children are malnourished. The average income in Kathmandu is 4.5 times that of Achham, and purchasing power parity has grown more than \$300 dollars in the Capitol between 1996 and 2001, while dropping \$7 per person in Achham. Similarly, while the national literacy level rose 12% over this period, it only rose 1% in Achham (to 26%) [1]. Nearly one in one hundred pregnancies result in the death of the mother [2].

Nyaya Health has specifically adapted its services to this community, focusing on the construction and expansion of mobile health teams, providing training opportunities to Nepali healthcare workers, and integrating appropriate communications technologies to provide healthcare services to a dispersed region. We have been

able to provide care to those who migrate, are unable to afford medicines and private medical providers, or are often distant from health centers. Health services in Achham were among the least developed in the country prior to Nyaya's operation. Achham has a population of 231,000 divided into 75 village development committees, with populations typically between 2,000 and 4,500 people. The transportation infrastructure is limited throughout the district, with only one paved road, which reaches only a small fraction of the district. Apart from Nyaya Health's staff, there is only one physician, at the district's one functioning hospital in Mangelsen (a six hour drive from Achham over unpaved roads). Workers at the hospital perform vacuum-assisted deliveries, manual removal of placenta, incision and drainage, suturing of lacerations, and external reduction and casting, but do not perform C-sections or any other surgical procedures, blood transfusions, thoracentesis, or paracentesis. The hospital has an inpatient unit with 8 beds, which are typically occupied. While there are a series of health posts, primary health centers, and sub-health posts that are closer-by, almost none of these are staffed; those that are staffed lack basic supplies and medicines, and have sometimes been wrongly used as private offices instead of public health centers [3]. Only 3% of births are attended by a trained health worker, reflecting the poor state of health services in the district [2].

As is typical for most of South Asia, approximately 80 to 90% of healthcare services are provided by private medical practitioners, few or none of whom have formal medical training. They often work or have worked as low-level practitioners (auxiliary health workers, health assistants, or auxiliary nurse midwives). These practitioners are completely unregulated and unaccountable to any government authorities. Private services are also rendered by traditional healers, although these are less widely utilized in our particular area. The other 10 to 20% of healthcare services include vaccines, tuberculosis treatment, and occasional health camps.

Nepal has an extensive network of unpaid female community health volunteers who reach even the most remote villages in Achham. They are recruited from their home communities and are trained by the government to provide preventive medicine services. Unfortunately, they typically receive few supplies and medicines and little continuing education. Nyaya Health is currently working within this network to better support these workers and optimize their unique skills and standing in the community.

Our Approach to Service Expansion

Through our research and service over the past two years, we have identified maternal health to be the most dire public health problem in the area, and of greatest need for timely action. The limited provision of health services in Achham has led to an understandable lack of faith in formal health institutions, and, combined with financial difficulties in accessing services, have resulted in few women seeking reproductive health services. By providing free services and assistance with transportation, we have taken important first steps in improving access to and utilization of reproductive health services. Additionally, our community health workers play a critical role in identifying and referring pregnant women for medical care. Expansion will proceed stepwise, building off this base, to ensure that expecting mothers have access to comprehensive emergency obstetric services.

Even as our primary impetus for expanding clinical services is to deliver comprehensive emergency obstetric services, we understand that these services must be provided in the context of general health services expansion. There are several important reasons why we are taking this integrated approach. First, the health needs of Achham are so great and broad that any single-minded approach will fail to reach the full potential for improving public health. Second, any purely maternal-focused interventions will receive less support from the major male-dominated power structures with which we must engage politically. Third, improving maternal health in general is about addressing overall *family* health. Finally, the existing government scheme includes general health services rather than those singularly focused on maternal health.

Our Capacity to Implement the Expansion

Nyaya Health is an organization that combines a community-driven on-the-ground approach to health services with technology-driven fundraising and technical assistance to roll-out high-quality health services. The efficiency with which we can scale up services was seen in our very first two months of operation of the Nyaya Health primary care clinic, where our team treated over 2500 patients and performed over 350 laboratory investigations. We have been able to rapidly but effectively expand our relationship with the government so that the government supplies essential medicines including vaccines, contraception, antenatal vitamins, antibiotics, anti-tuberculosis medicines, and antiretroviral therapy. Our community advisory and management boards ensure local ownership and accountability. They also form the basis of our grassroots advocacy network that facilitates approval processes and collaborations with the government.

We have also demonstrated a strong ability to generate funds and in-kind donations for our activities. We have received generous grants from the Ford Foundation, America Nepal Medical Foundation, William Prusoff Foundation, The Shelley and Donald Rubin Foundation, The International Foundation, Yale University, and numerous independent donors. We started a sustainable, market-based fundraising organization called EquityEdit. We have received a blood analyzer machine from QBC Diagnostics and an ultrasound machine from General Electric. We have an agreement within Nepal for free air cargo shipments with Buddha Air.

Our volunteer network of dedicated students, activists, and technical consultants continues to inject the ideas and support required to rapidly and effectively roll-out services. Our working groups connect like-minded individuals to work on a specific project requested by our Achham-based team (for example, malnutrition, indoor air pollution, or telemedicine). Our telemedicine team, for example, recently won first prize in the Yale Entrepreneurial Society's business plan competition. We were awarded the Open Architecture Network's grand prize for Asia, which has opened us to a large pool of designers, architects, and engineers. One of the design teams, Max Fordham, LLP, will be coming to Achham to build a telemedicine and community center, where people from the district will be able to access Internet-based educational activities, and where we will be able to interface with international physicians for radiology, pathology and similar telemedicine services.



Design of the Nyaya Health Telemedicine and Community Center

Purpose of this Document

This document provides the framework for the expansion of clinical services to the Bayalpata Hospital. A flexible approach is required to thrive in the challenging environment of Achham. This document describes both master timelines and contingency plans in the case of obstacles. The main text focuses on expansion of surgical and inpatient services; the appendices provide further information about services that are currently being provided at the Sanfe Bagar clinic and which will be developed in a similar fashion in Bayalpata. Note that the research and operational insights summarized in this document are detailed further in other open-access Nyaya Health documents and references provided on our website (particularly *District Health Facilities: Guidelines for Development and Operations*).

Bayalpata Hospital

History and Location

The site for service expansion will be the presently-abandoned Bayalpata hospital. This hospital is a 50-bed facility that overlooks Sanfe Bagar. This hospital was constructed in the mid-1980s and remains structurally intact. Constructed as a district hospital, the facility was abandoned shortly thereafter as a result of political redistricting that made Mangalsen the district headquarters of Achham. Local villagers surrounded the facility, refusing to allow Army officials to remove the hospital's equipment. At least six of the villagers were shot by the Army in response. Today, the hospital remains formally a part of the government system, although it is largely vacant. It is staffed, on average, one day a week by a mid-level health practitioner who provides minimal services such as basic medication dispensation from a single room. Local community members and government ministers have requested that Nyaya Health renovate, restock, and staff this hospital.

Achham is located at latitude 29N and longitude 81E, at a locale with temperate climate having annual temperature variations between 3 to 42 degrees Celsius, no snow fall but heavy rains. During the early morning of the winter months, 5-10°C is typical, but the temperature then rises over the day to up to 25°C. The peak summer months' temperature is typically up to 40°C Celsius. Rainfall is approximately 1250mm per year. The region experiences monsoon rains from June to September. The site is not located in a flood plain, being situated on a hill about 600 vertical meters above the river level.

Given the underdeveloped roads, the average transportation time to Sanfe Bagar is approximately two hours by foot for most patients, though many patients must travel 4 hours or more. This is not because our clinical sites are located in an out-of-the-way location, but rather because of the nature of the remote, hilly geography with poor transportation infrastructure. The clinical sites are actually in the largest transportation hub for the region, making them more accessible than other locations. Though most persons are accustomed to long walking distances, community healthcare workers (CHWs) are being trained and equipped with communications technology by Nyaya Health to develop an effective triage and mobile home-based service system. The hospital at Bayalpata faces similar transportation challenges that can be feasibly and effectively addressed through a community-based strategy employing CHWs to facilitate patients' arrival for surgical procedures or inpatient referrals from the clinic.



Map of Nepal, displaying the location of Achham

Scope and Scale of Hospital Services

The primary catchment area will be the 15 village development committees in closest proximity to the hospital (approximately 45,000 people). As has been the case with the Sanfe Bagar clinic, however, patients from throughout Achham and even neighboring districts to the north will likely come to the Bayalpata hospital, and

therefore we have calculated service demand in light of expected expansions to the effective catchment population.

The primary functions of the hospital will include:

- Delivering comprehensive emergency obstetric care
- Providing essential emergency and surgical capacity
- Housing overnight inpatient services in a 14-bed ward
- Providing diagnostic radiology services, including X-ray and ultrasound
- Providing general primary care and routine delivery services in a manner that complements and supplements the Sanfe Bagar clinic
- Serving as a linkage point for training and supplies for community-based care
- Expanding laboratory services currently being provided at the Sanfe Bagar clinic to include routine hematology, chemistries, and microbiology
- Serving as a blood transfusion center

Facilities Needs

The hospital is large enough to provide Nyaya Health with sufficient space for our patients' present needs, while allowing for gradual expansion to meet the predictable increase in demand over time. We will be working out the overall site plan, survey plan, zoning regulations, building codes, and fire codes in collaboration with local leaders, government engineers, and our staff members and volunteers. Here, we provide an overview of the facilities that we plan to develop. The approximate spacing requirements are shown below; these are estimates to guide planning, with the understanding that we will adapt each of these spaces based on further consultations with the engineering and architectural team. The spaces listed are a total for each line-item (i.e., not per-unit). Note that all current structures are on the ground floor of a one-story complex, saving construction funds and allowing for long-term safety and viability in the context of the region's climate.

Outpatient Department

- 1 reception and waiting space (24 m²)
- 5 consultation/examination rooms (50 m²)
- 3 treatment rooms (54 m²)
- 1 staff room (36 m²)
- 1 storage room (24 m²)
- 2 bathrooms (5 m²)

Emergency Department

General Space Requirements:

- 1 large area with 10 evaluation/treatment spaces (100 m²) divided by curtains on tracks. These spaces are equipped with emergency functions for: major trauma, fracture and orthopedic care, obstetrical and gynecological care, pediatric care, and general medicine emergencies.

Administrative Department

- 1 room for medical records, located adjacent to the admitting areas (30 m²)
- 1 room for accounting, audits, and cashiers (20 m²)
- 1 large room (36 m²) and 3 small rooms for centralized inventory management (30 m²)
- 5 administrative offices (10 m²)
- 1 AV telemedicine consultation/training room (20 m²)
- 1 server room housing up to three server computers (6 m²)
- 1 hospital laundry facility (50 m²)

Delivery Suite

- 4 routine delivery rooms (50 m²)
- 4 triage rooms (40 m²)
- 1 family waiting room (20 m²)
- 2 bathrooms (5 m²)

Clinical Support Services

- 1 X-Ray imaging room (20 m²)
- 1 computer room for staff (20 m²)

1 large laboratory divided by partitions for hematology, clinical chemistries, and microbiology, with space for expansion to include diagnostic pathology (60 m²)

1 pharmacy with storage areas and patient reception areas (40 m²)

Inpatient Services

12 general inpatient beds (120 m²)

2 isolation rooms for active tuberculosis (24 m²)

1 nurses station (12 m²)

2 supply closets (18 m²)

2 overnight call rooms (16 m²)

4 bathrooms (10 m²)

Blood Transfusion Services

1 blood storage facility with cold room at 4⁰ Celsius (40 m²)

2 supply closets (20 m²)

1 blood donations administrative office (12 m²)

1 blood testing laboratory (20 m²)

Surgical Services

2 operating theaters (48 m²)

2 pre-operation beds (18 m²)

2 post-operation beds (18 m²)

1 central sterile supply Area (40 m²)

2 bathrooms (10 m²)

Staff Living Spaces

20 staff quarter sleeping rooms (240 m²)

1 kitchen space (24 m²)

1 common living space area (30 m²)

4 bathrooms with bath and shower (16 m²)

2 small storage rooms (20 m²)

Engineering and Maintenance

Space for generator and central electrical wiring (16 m²)

Grounds maintenance equipment and tools (20 m²)

Mortuary area well-separated from other patient care and community spaces (40 m²)

Community Spaces

1 large multi-purpose meeting room (60 m²) capable of meetings for 50 to 100 people. This can be used for community activities, meetings, and training. It may also house a small library. An energy-efficient wood stove should suffice for heating needs during the coldest periods. Ceiling fans should suffice for cooling needs.

2 community computer lab spaces (24 m²)

1 small storage room (10 m²)

2 public bathrooms (5 m²)

2 counseling rooms (10 m²)

Inpatient Services

Scope and Scale

The initial phase of inpatient services will consist of 14 beds, two of which are designated for post-operative care and two of which are isolation rooms for active tuberculosis patients. The scope of services will include the following:

- Management of maternal and post-partum complications
- Provision of blood transfusions for post-partum hemorrhage
- Post-cesarean section and other post-surgical care
- Treatment of pneumonia, asthma and chronic obstructive pulmonary disease exacerbations, and other acute pulmonary conditions
- Stabilization of acute trauma patients and inpatient wound care
- Provision of intravenous antibiotics for the treatment of bacteremia, meningitis, cellulitis, pyelonephritis, endocarditis, and other life-threatening infections

- Essential care and treatment of acute coronary syndromes
- Stabilization of tuberculosis patients and initiation of therapy
- Management of acute malnutrition
- Treatment of severe dehydration

Other services will expand as epidemiological patterns demand and resources permit. Based on a 45,000 person catchment area, a typical annual incidence of admission of 1 in 35 in this area, and an average hospital stay of 4 days, we expect to have approximately 1,300 total admissions consisting of 5,200 hospital-days, with a maximum occupancy of 14 beds and a typical occupancy of 10 beds.

Design Considerations

The beds will be housed in separate rooms to facilitate infection control. Inpatient services provide accommodation for patients who are dependent on others because of their illness. Due to extended travel times for families and patients to reach our facility, provision must be made for the comfortable and safe overnight stays of family members, which can improve adherence to medical therapy upon release.

In the initial phases of our expansion, for ease of management and because there are only minor differences between the requirements of medical and surgical wards, all inpatient will be housed within one facility. As we expand, however, we plan to enhance the degree of specialization of the wards.

Administrative and support services will be located interior to the community-encounter spaces, including accounting, pharmacy, and outpatient. We will have individual rooms, as opposed to the congregate rooms typical of most district-level hospitals, for the purposes of infection control, and to facilitate a more peaceful and healthful stay for patients and their families.

Essential Emergency and Surgical Services

Scope

The emergency department and operating theater will be renovated in consultation with our hired MD-GP physician and with technical surgical consultants from Kathmandu and the United States. In the first few years of operation, only a single operating theater is sufficient, for primarily emergency surgeries. As funds and an additional surgeon become available, we will add a second operating theatre. The driving rationale for surgical services is to provide cesarean section capacity to combat crisis-level maternal mortality. This will be the primary focus of training and staffing, and is feasibly met by a team led by an MD-GP. Given the acute need for general surgical services and Nyaya Health's approach of comprehensive health systems strengthening, we will also aim to rapidly develop the human, technical, and financial capacity to meet the range of essential emergency and surgical needs of a district-level hospital, which include:

- Cesarean section
- laparotomy
- appendectomy
- cholecystectomy
- hydrocele reduction, incision and drainage
- wound suturing
- control of hemorrhage with pressure dressings
- debridement and dressing of wounds
- surgical treatment of acute infections
- head, chest, and abdominal trauma
- hernia repair
- amputation
- management of acute closed and open fractures
- management of wounds and burns
- common dental and ocular emergencies
- trichiasis surgery through the SAFE strategy [4]

Typically, in a district-level hospital, one operating theatre is required for every 50 general inpatient beds and for every 25 surgical beds. We also calculated demand for an additional operating theater in our setting by collecting data on patient flow over time at our clinic. Given the facilities and grounds available at Bayalpata hospital, space will not be a limiting factor as services and demand expand. The surgical protocols used at the hospital will include *Best Practice Protocols: Clinical Safety Procedures* published by the Clinical Procedures Unit, World Health Organization, as well as *Surgical Care at the District Hospital*, the primary

reference text for generalist surgical care in rural areas worldwide. These will be supplemented by training conducted by Nepali and expatriate volunteer surgeons, and by the knowledge and expertise of our hired surgeon.

There will be an anesthesia program led by the MD-GP in conjunction with staff nurses and health assistants trained in anesthesia. The main functions of the anesthesia team include:

- Provision of local, regional, and general anesthesia
- Airway management
- Resuscitation
- Pain relief

In the initial phase of the program, as is common at district hospitals in Nepal, the anesthesia team will be directed by the MD-GP physician and will be implemented by mid-level anesthetist practitioners.

Emergency Room Design Considerations

We have designed an emergency room space that allows for both the fast-paced work of the emergency environment and the flexibility to manage serious trauma cases. The ER will be housed in close proximity to the inpatient units, operating theater, and diagnostic radiology suite. This location provides easy, private access to ambulances, and secure, private access for walk-in patients and their families. For many patients, intake will occur in the adjacent outpatient department, with subsequent referral to the emergency room for minor surgical or other procedures, observation, or acute interventions.

Operating Theater Design Considerations

The overall design of the operating room will take into account the following requirements for a safe operation:

- Wounds heal (aseptic technique);
- Blood loss is replaced (intravenous infusion);
- Procedures are painless (anesthesia).

The operating room has been designed to be comfortable and unobstructed by the movement of other staff, with a table that is strong enough to hold patients and easy to clean, and provide basic services of water, light and medical gases. The center of the operating theater will be the cleanest area, with the requirement for cleanliness decreasing towards the perimeter of the department. Thus, any space for handling sterile supplies will be in the central area, and any space for transporting patients, general staff movement and removal of used material will be placed on the perimeter.

The location of the operating room follows the guidelines that it:

- be connected to the surgical ward by the simplest possible route;
- adjoin the central sterile supply department;
- be easily accessible from the emergency department;
- be easily accessible for the delivery suite;
- adjoin the intensive care unit;
- be located in a cul-de-sac, so that entry and exit can be controlled;

A single corridor will be used to carry patients, staff and clean and used equipment (suitably bagged) to and from the operating theaters. This corridor leads to each operating theater via an anesthetic room, a scrub-up facility, and a separate theater exit. Rooms are arranged in continuous progression from the entrance through zones of increasing sterility, following the concept of progressive asepticism. Staff within the department will be able to move from one clean area to another without passing through unprotected or unclean areas. Patients, staff and services will enter through the same control point. Unit room air-conditioners (window type, with 1 ton capacity per 18 m², at least one per theater) can be provided as a stand-by. Ventilation and air conditioning will have outside exhaust. Furthermore, the operating theatre will be at positive pressure in relation to adjacent rooms. Air movement in the operating theatre will be vertically transferred so that airborne infections do not reach the patient. Windows are neither needed nor desirable. All surfaces in the operating theatre will be smooth and washable. Static electricity and related hazards will be avoided. Special anti-static floors will be provided, since floors in which the electrical resistance is below the intended limits can result in electric shocks. When inflammable anesthetics are used regularly, the anti-static requirements will extend to the walls, or at least 2 m from any possible location of the patient and the anesthetizing apparatus.

Full outside air, filtered to a high quality, will be provided. The integrity of the air-handling system must be preserved by careful placement of the main air intake and exhaust. The main air intake will be located to avoid uptake of any obvious airborne contamination, such as dust and road fumes, and well clear of the main exhaust duct, and the placement will take into account the direction of the prevailing wind. Temperature and relative humidity should be controllable by this unit.

Most instruments and equipment will be sterilized in the adjoining central sterile supply department. Dressings and gowns will be sterilized in the central unit to minimize the requirements for additional large, expensive autoclaves. A small "dropped instrument" sterilizer will be located within each theater. The area provided at the center of the theater for storing sterile supplies and instruments will also be used as a set-up room for laying out the sterile instruments and supplies required for an operation on the trolley (central trolley preparation). This system requires that the central working area be large enough to park several theater trolleys.

The entrance to the operating department will have a reception and transfer point that enables control of unauthorized, unsupervised entry into the area and ensures the principles of aseptic conditions. The transfer area is the point at which the patient is physically removed from the bad trolley to the theatre trolley.

Specific Spaces

- *Reception and office.*
- *Transfer area.* This area will be large enough to allow for the transfer of a patient from a bed to a trolley. A line will be clearly marked in red on the floor, beyond which no person from outside the operating department will be permitted to set foot without obtaining authority and putting on protective clothing.
- *Holding bay.* This space is required when the corridor system is used and will be located to allow supervision of patients waiting to go into the theatre.
- *Staff changing rooms.* Access to staff changing rooms will be made from the entry side of the transfer area. At both the transfer area and the theater side of the changing rooms, space must be provided for the storage, putting on and removal of theater shoes.
- *Operating theaters.* The operating theater will be larger than 6 x 6 m (36 m²) in area and will have access from the 1 anesthetic room, scrub-up room and supply room. Separate exit doors will be provided. There should be space for an immediately adjacent operating theater once we expand beyond the initial MD-GP-led emergency surgical capacity.
- *Scrub-up room.* A clear area within the scrub-up room of at least 2.1 x 2.1 m will be provided for gowning and for trolley or shelf space for gowns and masks.
- *Sub-sterilizing.* An area for sterilizing dropped instruments will be provided to serve two theaters.
- *Trolley parking.* Parking space outside the theatre and clear of all doorways will be provided for patient trolleys and beds.
- *Recovery room.* The recovery room will be located on the hospital corridor near the entrance to the operating department. The number of patients to be held until they come out of anesthesia depends on the theater throughput; two beds per theater is usually satisfactory. If an intensive care unit is later developed, additional rooms and facilities will be needed.

Role of Surgical Camps

Surgical camps play an essential role in care provision and training. Their role is to provide critical but non-emergent surgical care that can be screened for and referred to through our general primary care programs. Appropriate surgical camps can provide essential, sustainable services in keeping with Nyaya's overall approach to health systems infrastructure development. When specialist surgeons do come to our remote site, they will also provide important training and dialogue with our generalist clinical team. While on-site, they may provide generalist care as an aspect of training. For example, an obstetrical surgeon coming to our hospital for a uterine prolapse camp may perform emergency cesarean sections with the MD-GP to assist with continuing surgical education and to teach new, more efficient or effective techniques. The following are some of the types of camps that are consistent with our aim of providing essential referral services to the communities served by the hospital:

- Obstetric surgical camps (treatment of uterine prolapse, surgical management of menometrorrhagia)
- Ophthalmological camps (cataract removal)
- Dental camps (fillings, extractions, cleanings)
- Cardiology camps (screening for valvular dysfunction requiring surgery)

Expanded Laboratory Services

Scope and Scale

Our laboratory will build significantly off of the high-quality laboratory services provided currently at the Sanfe Bagar clinic. The laboratory manual for these services, currently being employed at the clinic, is available online: <http://nyayahealth.pbwiki.com/Laboratory>. The following are the services already being offered through the clinic; these will be built upon and expanded at the hospital:

Colorimetry-Based Tests

- Hemoglobin (Drabin's), primarily for antenatal screening
- AST (DNPH), primarily for evaluation of patients on antiretroviral/antimycobacterial therapy
- ALT (DNPH), occasional use among complex patients
- Bilirubin (DMSO), primarily for triage and evaluation of neonatal jaundice
- Creatinine (Jaff), primarily in triage of acutely ill patients
- Glucose, Serum (Glucose Oxidase)
- Albumin (BCG), occasional use in evaluation of malnutrition
- Routine Microscopy:
 - Gram Stain
 - Wet mount
 - KOH prep
 - Sputum for acid fast bacilli (integrated within Nepal government's national quality control system-- we send all positives and 10% of negatives to national lab)
- QBC AutoRead Plus Tests:
 - hematocrit
 - hemoglobin
 - mean corpuscular hemoglobin concentration
 - platelet count
 - white blood cell count
 - granulocyte count and percentage
 - combined lymphocyte/monocyte count and percentage
- Rapid Kit-Based Tests:
 - RPR
 - HIV
 - Anti-ABD, pregnancy screening
 - Glucometer and cuvettes
 - Urine, protein/glucose, for use in antenatal screening
 - Urine, 9-panel, for use in UTI evaluation
 - Urine, beta-HCG for pregnancy

The next steps in our expansion, surgical and inpatient services include:

- Culture Microbiology including mycobacterial (tuberculosis) culture
- Additional colorimetry-based tests (amylase, lipid profile, CSF Protein, CSF Glucose)
- Technician-based Microscopy (Stool examination, CSF cell count, thin blood smear, urine sediment microscopy)
- Blood transfusion laboratory tests (HBsAg, HCV, DAT, IAT, RBC antibody, crossmatch)
- Chemistry analyzer
- Immunodiagnostics (e.g., TSH)

A comprehensive laboratory will typically have the following sections: 1) Morbid anatomy, 2) Hematology, 3) Clinical Pathology, and 4) Microbiology. For the first few years of our hospital planning, as is typical for most district hospitals in Nepal, these will all be housed under a single laboratory and run by a lab technician rather than an MD-pathologist. For that reason, labs related to morbid anatomy and clinical pathology will be minimal. We will expand from the basic services described above as demand and available resources dictate.

Design Considerations

The laboratory design is intended to:

- Provide safe, direct access for patients
- Allow efficient and safe receipt of chemicals deliveries
- Allow efficient and safe disposal of laboratory materials and specimens

Spaces in the lab design include:

- Bench space (approximately 6 m² per staff member)
- Sterilization and washing areas
- 2 Storage rooms
- Nearby storage space for hazardous chemicals

Laboratory workload tends to double every 5 to 8 years. The growth of our lab is likely to be even faster as the out-patient department is strengthened to integrate provisions for primary healthcare services. The plan for laboratory workbenches is therefore flexible and incorporates a modular strategy. That is, the basic building unit is a laboratory module of a particular width, depth and height. This contains all of the standard features needed to support the laboratory activities, including wet and dry services, lighting, electricity and ventilation. It can be repeated as many times as necessary to make up a laboratory of the required size.

The external walls of the laboratory will be of permanent, durable construction, but the partition walls should be considered to be temporary so that they can be taken out or easily replaced with expansion. The ceilings will be made of materials that are easily cleaned and disinfected so as to reduce airborne contamination. They will be 2.55-2.80 m in height to allow for wall-mounted distillation racks and related equipment. The floors will be made of materials that are resistant to acids, alkali and salts and can be easily cleaned and disinfected. An installation with a minimal number of joints is intended.

The bacteriology unit will be located at the farthest end of the laboratory, next to the washing and sterilizing unit, to diminish the hazard of contamination. The quantities of dangerous chemicals (particularly inflammable ones) held in the department will be limited and strictly controlled by the detailed manual constructed by our current laboratory technician.

Doors have been planned for locations where entry and exit is easy and does not interfere with the laboratory benches or equipment. Laboratory doors will be no less than 1 m wide to allow easy access of equipment. In some areas, double doors at least 1.2 m wide will be provided for passage of large equipment, such as deep-freezers. All doors will open towards the corridor.

The basic utilities to be provided in the laboratory are water supply, sanitary drains and drain vents, electricity, compressed air, distilled water, carbon dioxide, steam and gas. Others may be necessary depending on the types of tests to be performed. The following color code will be used to identify different pipes in the laboratory:

- hot water: orange
- cold water: blue
- drain: brown
- steam: gray
- compressed air: white
- vacuum: black
- gas: yellow
- sprinkler: red

Blood Transfusion

In Nepal, the sole authorized provider of blood transfusions services is the Nepali Red Cross. The nearest centralized blood bank is approximately 10 hours away from Sanfe Bagar. We have already contacted the Nepali Red Cross and have begun coordinating the blood transfusion services planned for our site in line with their protocols and standards. We will be integrated within the national centralized blood bank system. In the initial phases of development, we will provide the training and build the storage capacity for the system. This includes a system of locally-screened voluntary, non-remunerated blood donors for initial operations prior to linkages with the national supply chain. Donor recruitment in this case will be conducted through our community-based management structures and will be an important aspect of community engagement and involvement. The standard Nepali Red Cross intake form will be used, recording blood pressure and weight, inquiring about possible blood-borne pathogen exposure, and testing for anemia, compatibility, and infectious agents, including human immunodeficiency virus (HIV), hepatitis B virus surface antigen, syphilis, and any other conditions as determined by national policy and standard exclusion criteria.

In the planning phases, we aim to have capacity of 50 units of blood at one time as a district-level facility. Our design will consider the possibility of long-term expansion to a regional center with capacity of up to 300 units of blood at one time.

Design Considerations

Key points in design of the blood transfusion center:

- Donors, blood, and patients will have separate transit pathways.
- The blood testing laboratory will be housed within the general laboratory unit.
- Loading and unloading facilities will be covered to protect from weather.
- The blood bank will have access to the stand-by generator in the event of power outage.
- Owing to the intermittent nature of voluntary blood drives, donor collection areas will be in spaces having other functions, most likely the community-interaction spaces.
- Sterilization, laundry, maintenance, and storage services will be integrated with our centralized systems.

The design of the blood transfusion center will be fully coordinated with the Nepali Red Cross to meet their national guidelines for safety, quality, and monitoring.

Diagnostic Ultrasound

Ultrasound is a diagnostic modality critical to effective obstetrical management. Although basic obstetric ultrasound can be performed reliably, accurately, and in a cost-effective manner by trained generalist physicians, mid-level practitioners, and midwives, it is typically not available in resource-poor settings.

In this context, we will be deploying a rugged, portable machine with a 3.5 MHz convex transabdominal transducer to perform basic obstetric ultrasound. With our generalist physician-led clinical team, obstetric ultrasound will first serve to answer the following three core clinical questions. The ability of the clinical team to answer these questions will enable timely, efficient, and cost-effective triage and referral (since our obstetric referral hospital is 10 hours away over difficult terrain):

- Is there a viable intrauterine pregnancy? This is critical in evaluating for possible fetal demise and ectopic pregnancy.
- What is the placental location? This is essential in evaluation of bleeding in pregnancy and ruling out placenta previa.
- What is the fetal lie? Given the unreliability of Leopold's maneuvers and our extreme distance from an operating theatre, identifying fetal lie will be essential in the decision to deliver on site or to refer.

These simple clinical questions can be answered by a generalist physician-led team without the need for specialized radiological staff. More complex diagnostic questions can be addressed by this machine as clinical need demands and resources permit. In particular, we hope to quickly add a transvaginal transducer and identify trainers so that ectopic pregnancies, important in our area where a history of pelvic inflammatory disease and septic abortions are common, can be effectively diagnosed. The portability of the machine is critical for servicing and for performing outreach to villages. Travel to Achham from Kathmandu is expensive and long, and getting on-site technical consultations is challenging. The clinic is located centrally for outreach, but given the dispersed nature of the villages, many communities that we serve are located over two to five hours by foot.

Finally, although low quality images are sufficient for the initial basic applications, high-resolution images are needed for quality assurance and training purposes. Through the telemedicine center we are constructing with the Open Architecture Network and Advanced Micro Devices, we will be conducting telemedicine applications to improve our staff's diagnostic reliability and accuracy. This is critical, given the difficulty in recruiting specialists to rural sites for extended periods. These training modules will be achieved through a store-and-forward strategy whereby we send images via our secure telemedicine portal run through [Rural Health Online Nepal](#) over the Internet to Kathmandu-based consultants (primarily through collaboration with Kathmandu Model Hospital). Our Kathmandu partners provide consultations, quality assurance, and feedback to our staff. Additionally, these consultants occasionally make site visits with obstetrical teams to provide further training and technical assistance.

A simple-to-use form that is integrated with our existing [clinical records system](#) will be filled out by the provider on each ultrasound examination. This form includes space for relevant electronic ultrasound images. A group of Yale-based volunteer clinicians directed by our Board of Advisor's member Dr. Christopher Moore will undertake external quality assurance on these images. The following are the three key outcomes that will be assessed:

- Number of encounters, by provider, clinical indication, and ultimate disposition (to home, delivery, referral);
- Quality and appropriateness of images provided (assessed by a standardized quality assurance protocol by external specialist reviewers); and
- Appropriateness of the treatment plan based on the ultrasound images.

Nyaya Health will compile reports with the detailed performance markers, case reports, estimates of clinical impact, ultrasound images, and photos of the machine in use. To the extent possible in keeping with research ethics and publication guidelines, these reports will incorporate whatever operations research has been conducted at the clinic.

The GE LogicBook XP will best meet our service needs for a durable, reliable, inexpensive portable ultrasound machine. It is also sufficiently sophisticated that, as we expand operations, we will be able to layer on additional obstetric, surgical, and medical applications. The high image quality of this machine is suitable for telemedicine applications. General Electric, through the equipment donation company International Aid, has generously provided this machine to us.

Diagnostic X-Ray

Rationale and Approach

Chest, abdominal, and skeletal X-ray are critical diagnostic modalities for the generalist rural setting. X-Ray is an appropriate technology to guide diagnosis, treatment, and referral. The primary uses of the X-Ray at the Bayalpata Hospital will consist of:

- Evaluating childhood and adult pneumonia;
- Assessing traumatic long-bone fractures; and
- Diagnosis of tuberculosis.

Each of these applications can be effectively integrated within our primary care programs by our generalist healthcare staff. Effectively applying X-Ray technologies in the evaluation of respiratory tract infections will help to prescribe antibiotics in a safe and rational manner and to triage sick patients for referral. X-Ray for tuberculosis will be essential due to lack of services in the area and acute need. Traumatic bone fractures are exceedingly also common, considering the geographic terrain and high incidences of fall injuries, and X-Ray is the limiting factor in providing effective treatment. Our staff are equipped and trained to provide setting and casting of long-bone fractures, but appropriate radiological equipment is first required.

Additional applications include:

- Evaluation of congestive heart failure due to cardiovascular disease or rheumatic heart disease;
- Evaluation and triage of the acute abdomen;
- Evaluation and triage of intestinal obstruction; and
- Diagnosis of less common respiratory tract illnesses, such as fungal infections.

Similar telemedicine applications, monitoring, and clinical records integration will be pursued as with the digital ultrasound. A WHIS-RAD battery-powered portable digital X-Ray or equivalent will feasibly meet these needs, and we are actively pursuing obtaining a machine from the World Health Imaging Alliance.

Design Considerations

The walls of the X-Ray facility should have a protection capability equivalent of at least 0.25 mm of lead (1-2 brick-width thickness). The room should be at least 4 m x 5 m to allow for sufficient space for the X-Ray and for a safety zone surrounding the machine. The X-Ray facility should be located in close proximity to the emergency department.

Surveillance and Oversight

The main surveillance and health services assessments will take the form of data collected by health workers and clinicians in their routine care of clients. The hospital record system will build off existing clinical records that are maintained at the Sanfe Bagar Clinic. These data will be entered and stored electronically, assessed monthly, and published quarterly.

Along with these data looking at clinical presentations, diagnoses, and treatments, there will be a comprehensive accounting for the cause of every death, using community health workers to conduct “verbal autopsies,” an investigative technique that has been utilized by the WHO in identifying the complex causes of maternal deaths. The technique is being adapted to the particular religious and cultural context of the local community. The aim of this approach is to both identify key causes of preventable mortality in the community and to ensure that our organization is responsive and timely in ensuring high qualities of care. Taking into consideration privacy issues and the comfort level of the staff and the community surrounding issues of death,

parts of these data will be disseminated and discussed (after the data have been de-identified) by the health team in a morbidity and mortality conference.

As the program evolves, the prevalence of various conditions in the community will be more rigorously assessed. These data cannot be obtained by looking at health services utilization alone, and will require further outreach by community health workers into the community. Importantly, these data will be collected and integrated into a community-based intervention described in our participatory health deployment program manual for the Social Sciences Research Council (available on our website). For example, in the course of determining the prevalence of anemia among females of reproductive age in the community, females screened as likely having anemia will be sent for evaluation and treatment. The philosophy of this action is that community health worker resources are best spent by assisting us to ensure accountability to the community, through personal connections, surveillance, and interventions managed in an integrated fashion with clinics and hospitals.

The surveillance data collected will be used to monitor the progress and effectiveness of our clinical and public health programs, as well as to design new interventions.

Equipment Lists

Our equipment lists are detailed in spreadsheets downloadable at nyayahealth.pbwiki.com/SurgicalServices. The purpose of these lists is five-fold:

- Assist in planning, costing, and procurement;
- Facilitate international equipment donation groups to contribute to our infrastructure development;
- Compile the necessary lists to continue our negotiations with the Nepal government;
- Facilitate dialogue on appropriate, efficacious, and cost-effective equipment among staff and volunteers; and
- Provide a modular development strategy to allow for step-wise expansion of services, in keeping with our overall approach.

These lists will be periodically updated as we evaluate the progress of our operations, training, scope of services, and overall model. The ordering of this equipment list parallels that of the text and the overall timeline and strategy. The list is accompanied, where necessary, with notes concerning the equipment specifications.

Hospital Operations

Planning Process

Throughout the planning process, we have involved our Nyaya staff, donors, government officials, local leaders, and outside contractors to plan the hospital's operations. The process aims to both develop local capacity and build long-term infrastructure and human resources. The planning process proceeds in the following overlapping phases:

- *Needs and resources assessment.* This has been ongoing through our work at the Sanfe Bagar Medical Clinic. We have already established a strong demand, community mobilization, and government interest in renovating, equipping, and staffing the hospital. We will continue to quantify demand, further engage the community, and negotiate with the government to ensure long-term sustainability of the program.
- *Design brief preparation.* This document is the culmination of several discussions by various team members, and will continue to evolve as the planning process proceeds.
- *Renovations.* The renovations will be led by a set of identified local contractors and in collaboration with the government, with oversight from our designated team leaders.
- *Commissioning.* Finally, our team has generated an implementation plan to staff the hospital; commission and procure the necessary equipment, furniture and supplies; and supervise and streamline the actual service delivery including its training, evaluation and improvement components.

Key team members have been identified as participants during this process, including:

- *Project managers* who have begun to assess the needs and resources for the hospital, its role in the community and the services it will offer. These planners are drafting the functioning of the different departments and of the hospital as a whole, producing budgets and identifying earmarked funds for the project, and establishing the relationship between the hospital and the surrounding villages it serves.
- *Construction managers and architects* who are identifying the resources and contractors to ensure that the project is completed on time and within the budgeted allocation. Architects also provide guidance on design aspects of the renovations.

- *Civil and mechanical engineers* who provide guidance on the safety of structures and the layout of technical wirings, water mains, and gas lines. This includes guidance on waste management, construction of septic tanks, incinerators, and burial pits.
- *Quantity surveyors* who assist in site assessment and planning, and work with our procurement staff to ensure safe, cost-effective, and reliable supply chains.
- *Clinical care staff* who will be directly involved in providing services. These include doctors, nurses, nurse midwives, health assistants, and laboratory technicians.

Renovations

In addition to paid contractors, local government civil engineers who have assisted us as volunteers in surveying lands adjacent to our clinic in Sanfe Bagar are assisting in site surveying, planning, and renovations. Through our alliances with the Open Architecture Network, we are recruiting teams of hospital architects who are providing pro-bono consultations during the course of the renovations.

Water Supply

A safe, clean water supply is critical to the functioning of the hospital. Given that the water lines to the hospital have long been abandoned, Nyaya Health has worked with the community to reconnect new water lines for sufficient supply.

Prior treatment of the water is critical to operations, and the water filtration system we are installing allows our water supply to meet the following criteria:

- free of pathogenic organisms and biosolids;
- free of poisonous substances;
- free of fuel oils;
- free from corrosive substances;
- having less than 60,000 total maximum daily loads of pollutant materials;
- being clear, colorless, odorless and tasteless;
- meeting U.S. EPA standards for calcium, magnesium, manganese, iron, and carbarbonate concentrations;
- hard for domestic and industrial use; and
- at a low, drinkable temperature.

The amount of water required is approximately 150 liters per person per day, including that needed for grounds maintenance and in the case of fire. In initial phases of hospital use, this will cover approximately 50 staff and 25 inpatients. To allow for buffering and room for expansion, we will aim for a water supply for at least 150 persons initially. The typical pressure required is 3.5 kg/cm²; for fire protection, we will need pressures capable of 7.0 kg/cm². Storage facilities for treated water will aim to have a 48-hour supply. The exact details of the water supply system (collection, treatment, and distribution) are detailed in a separate document by our collaborating civil engineers from the government.

Supply Management

The current supply chains utilized by Nyaya Health at the Sanfe Bagar Clinic are of high quality, reliable, and insured. These will provide the base from which to build the hospital logistics system. In our system, we take a redundant approach in which we prefer to receive supplies from the Ministry of Health, but have private vendors available on-call in Kathmandu (Bikash Surgical Concern and Medical Services Management Trust) and Dhangadi (Western Pharma) to ensure a consistent flow of supplies in the event of government supply chain interruptions. Supplies are also supplemented by in-kind donations from international sponsors. We have signed an agreement with the airline company Buddha Air for free cargo shipments on all flights from Kathmandu to the nearby airport in Dhangadi. A main objective with our work at both the clinic and the hospital is to work with the central government to improve supply chain management, foster investment by the government and confidence of local people in their officials.

For management of supplies, we will have used a centralized and electronic supply system that intakes, records, and checks all supplies as they arrive at the hospital. As we do at the Sanfe Clinic, trained logistics managers oversee the process and record all supplies through mSupply, a software program developed in Nepal. We detail our supply chain on our wiki through the budget portal: <http://nyayahealth.pbwiki.com/Budget>.

Laundry and Domestic Services

The hospital will have a centralized laundry and domestic supplies services located in the interior of the facility. During the design and operations process, attention is being paid to maintaining ecologically-friendly cleaning practices.

Facilities for these services include a:

- soiled linen room;
- clean linen and mending room;
- laundry-cart storage room;
- laundry processing room, with equipment sufficient to take care of 7 days' linen;
- janitor's closet, with storage space for housekeeping supplies, equipment and a service sink; and
- storage space for laundry supplies.

Food and Dietary Services

The hospital will have central food services for patients admitted to the hospital, as well as for patients' families, outpatients, staff, and visiting health workers. The following principles of food preparation will be adhered to:

- Use of locally-grown food;
- Attention to balance, calorie count, and appropriate amounts of salt and protein; and
- Tasty food appropriate to local culinary customs.

Food services will be run in conjunction with a dietary team. This team is headed by a nurse with training in dietetics. She will work in conjunction with the cooks to ensure that the above requirements are met.

The following spaces are required for food processing:

- food refrigeration and storage;
- cooking;
- dishwashing;
- cart storage area;
- cart-cleaning facilities;
- waste disposal facilities (integrated within the general waste management scheme); and
- dietitian's office.

Many of these can be housed within a single facility with connected, small rooms. Direct deliveries to the refrigerated section eliminate traffic through corridors and cooking areas. Airflow as it affects aromas, including the direction of the prevailing wind, will be considered. Dining facilities will be pleasant, clean, and have space for approximately 1.5 m² per seated person.

Energy Generation

We will build upon our experiences at the Sanfe Bagar clinic in providing sufficient and reliable power for our operations in a remote area. The base of the system will be the electricity grid with back-up diesel generators. To the extent possible, however, we will attempt to replace this with solar and other renewable technologies. Through a combination of electrical grid, solar photovoltaic, wind, and generator, we will aim to have a reliable system capable of delivering 30 kWh per day. Present estimates of energy needs for the hospital are as follows:

Energy Needs

Device	Quantity	Power (Watts)	Total Watts	On-Time (hours/day)	Wattage (kWh/day)
Vaccine Refrigerator	4	60	240	8	1.9
Small Refrigerator	3	300	900	6	5.4
Centrifuge	2	575	1150	3	3.5
Microscope	4	15	60	3	0.2
Lighting	7	15	105	10	1.1
Fans	5	30	150	10	1.5
Incubator	1	400	400	6	2.4
Water Bath	1	750	750	2	1.5
Communications Systems	1	100	100	24	2.4
Desktop Computer					
Power Save Mode	3	50	150	7	1.1
In Use	3	150	450	5	2.3
Printer	1	65	65	2	0.1
Portable X-Ray	1	3000	3000	1	3.0
Oxygen Concentrator	1	300	300	3	0.9
Totals			7,820		27.1

Additional considerations:

Sufficient battery storage is critical for efficiency and reliability. In procuring batteries, consideration of the ultimate life-cycle, and how to dispose of them following use (typical life of 5-10 years), is critical in ensuring environmental and human health. A system is being implemented for safe processing of these batteries in Kathmandu, Nepal. We are also working with companies based in Nepal and elsewhere to identify renewable technologies appropriate to our rural setting, which are capable of being brought to scale in other areas. Some energy is likely be generated through local technologies, such as micro-hydropower and biogas fuel. Our energy team has developed a detailed plan required for the implementation of these approaches.

Waste Management

Waste management strategies will build off of the ecological and cost-effective approach we have taken at the clinic. The details of our waste management strategy, including costing and construction for incinerators and waste pits, are available here: <http://nyayahealth.pbwiki.com/Waste-Management>

Most of the operating procedures and protocols are available in the waste management page document; here we will provide an overview of the main considerations relevant to planning, design, and costs.

Wastewater is the liquid waste generated by the hospital. Given the presence of laundry facilities and an operating room, the amount of liquid waste is significant. The processes of disposing of wastewater involve: *Treatment of raw wastewater.* This is achieved through a large septic tank system in which storage of the raw wastewater in a contained environment allows for bacterial digestion of biologically harmful agents. Although the resources for oxidation pools are likely to be beyond our means at the present time, they are a desirable alternative to be considered as land, financial, and human resources permit.

Effluent discharge. The effluents from properly designed, operated and maintained wastewater treatment units can be safely injected into the ground or discharged on the land. Wastewater treatment plant effluent constitutes a valuable source for recharging groundwater. However, the points of recharge will be well-arranged and the quantities limited so that there is no threat to the quality of the groundwater.

Solid waste is separated into categories on the basis of the relative hazard to public health and the means of disposal. Typically over 80% of waste generated in health care establishments is non-hazardous, general waste. In order to reduce the cost of waste management, it is essential to segregate the hazardous waste from the nonhazardous component at the point of generation. Non-hazardous waste consists of:

- General domestic-type waste: household-type wastes from offices, corridors, public areas, supplies departments, newspapers, letters, documents, packing materials, cardboard containers, plastic bags/films, food wrappings, metal cans, food containers, flowers, floor sweepings.
- Kitchen waste: food waste, swills, etc.

Non-hazardous waste does not require special treatment and can be disposed of as normal household or office waste. As we do at the Sanfe Bagar clinic, this will be done through a burial pit.

As described in our waste management protocol, the hazardous health care waste will be categorized and subject to different color-coded containers and disposal methodologies:

- Infectious wastes other than contaminated sharps include: 1) soiled surgical dressings, cotton wool, gloves, swabs and all other contaminated waste from treatment areas; plasters and bandaging which have come into contact with blood or wounds; cloth and wiping materials used to wipe body fluids and spills of blood; 2) material other than reusable linen from patients having infectious diseases; 3) pathological waste, including human tissues, organs, limbs, body parts, placenta and human fetuses; and tissues from laboratories and all related swabs and dressings; and 4) waste arising from laboratories and postmortem rooms.
- Sharps include discarded syringes, needles, cartridges, broken glass, scalpel blades, saws and any other sharp instruments that could cause a cut or puncture and could be infected.
- Pharmaceutical waste includes expired drugs, vaccines and sera, including expired drugs that have been returned from wards, drugs that have been spilled or contaminated, and drugs that are no longer required.
- Chemical waste arises from a variety of sources within health care services, but results primarily from clinical laboratories and associated services. Chemical waste comprises discarded solid, liquid and gaseous chemicals, such as those from diagnostic and experimental work, cleaning, housekeeping and disinfecting procedures.
- Pressurized containers include compressed gas cylinders, aerosol cans and disposable compressed gas containers.

A combination of incineration and burial will be used for these wastes. The incinerator will be based upon the design used at the Sanfe Bagar clinic (adapted for local conditions from the Montfort design).

In larger hospitals, cytotoxic and radioactive wastes are also generated, though this is rare at most district hospitals in Nepal and will certainly not be generated at our hospital in the foreseeable future.

Communications

Internal Communications Systems

The primary mode of internal communication between staff within the hospital will be through short-distance handheld radio devices ("walkie-talkies"). There will additionally be a public address system and a patient call-button system.

Phone Systems

To ensure reliability of our communications system, we have three primary mechanisms for voice communication: Very Small Aperture Terminal (VSAT) phone, landline telephone, and cellular (CDMA) phone. CDMA and VSAT are both currently utilized by the Sanfe clinic effectively; landline telephone service is not available in Sanfe but is in Bayalpata.

Internet System

The interaction between healthcare workers and timely medical information is a critical part of our telemedicine strategy. Community healthcare workers benefit greatly from access to Internet-based medical resources. Due to the vast distances of undulating landscape, the best solution for our area is a communications link for long-distance Internet availability. Based on our analysis and previous successful implementations by other NGOs, we have decided that VSAT internet provides us with the best solution. We currently have a leased line at the Sanfe clinic that has been performing well, and for which we are collecting bandwidth and reliability data to assess the value of renewal and further expansion.

VSAT systems offer several advantages over competing technologies, such as dedicated cable lines or CDMA links, in providing internet connectivity to rural locations. The most beneficial quality of VSAT is its unrestricted and unlimited reach to almost any location on earth. This is accomplished through a comprehensive set of orbiting satellites which communicate with ground based VSAT systems. VSAT systems also have high reliability of up to 99.9% [5], which is essential for providing dependable healthcare support. Another consideration for our application is the ability to scale-up our network without major restructuring as new clinics are introduced to the area. VSAT systems can be easily modified to accommodate additional clinics and reconfigured to build multiple network configurations, including ad-hoc, broadcast, and hybrid networks for multiple applications.

Furthermore, VSAT technology is readily scalable. As we add new peripheral clinics, the VSAT satellites at each clinic can be configured into a meshed network [6]. The mesh network will have a main VSAT hub, the central clinic, and remote VSAT satellites which can all communicate with the central hub. The central hub will be responsible for processing and recording all patient data from the remote locations, while simultaneously broadcasting valuable information to the remote clinics.

Engineering and Maintenance

Heating, Cooling, & Ventilation

Together with our engineers, we are developing design strategies that maximize energy efficiency. Throughout the year, temperatures in Achham range from 44°F in the summer to 3°C in winter.

We are pursuing strategies for cooling during summer such as optimizing air flow, appropriately using natural ventilation and shade, and maintaining proper insulation. Apart from energy efficient design, fans are probably the only additional machines needed for cooling. Additional strategies for heating during the winter will include solar positioning of the inpatient ward, proper insulation, and use of natural heating sources for warming. Locally-distributed heating systems are being considered for use primarily for early morning and evening events during the winter. Locally-distributed air conditioning (particularly for operating rooms) will likely be pursued as opposed to central air conditioning. All rooms, particularly those housing digital equipment, should be designed appropriately to protect equipment from excess moisture and extreme temperatures. The desired temperatures are:

Operating theater: 21-25°C

Delivery room: 21-25°C

Recovery room: 23-25°C

Nursery: 24-26°C

Inpatient unit: 20-26°C

Air supply and air exhaust systems should have mechanical operation. Areas such as the operating theater, delivery room, nursery, and sterile rooms should be equipped with at least two filter beds. The circulation and pressure requirements are shown below. Filter frames should provide an airtight fit with enclosing ducts and should be gasketed or sealed.

Ventilation Requirements

Area	Relative Pressure	Hourly Air Changes	Recirculation
Anesthesia Storage	0	8	No
Delivery Room	+	12	No
Inpatient Ward Room	0	2	No
Laboratory, general	-	6	Permitted
Laboratory, media	+	4	No
Nursery	+	12	No
Operating Theater	+	12	No
Recovery Room	0	6	No
Sterilizing Room	-	10	No
Treatment Room	0	6	No
Ward Corridors	0	4	No
X-Ray Room	-	6	No

Medical Gas Supply

In the initial phases, medical gas supply will be decentralized, with design to account for eventual expansion to a centralized gas supply. The following units will share an oxygen concentrator: emergency, operating theater, labor and delivery, and inpatient. The only location of anesthetic gas supply will be in the operating room, as detailed in the surgical services section.

Fire safety

A minimum of two fire safety compartments will be provided per floor, with standardized fire doors and facilities to stop fire and smoke. Larger continuous floor areas on any story require more fire compartments to ensure greater opportunity for progressive evacuation. During the renovations process, maximum amounts of fire-resistant materials should be used in constructing the buildings, false ceilings and partition walls, to have the requisite fire resistance and flame-spread ratings as outlined in the code.

Lighting

The minimum lighting requirements for each type of facility are detailed below.

Lighting Requirements

Area	Minimum lux
Bathroom	100
Blood Bank	200
Delivery Room	400
Outpatient Dispensary	300
Inpatient Ward Room	300
Laboratory	250
Mortuary	100
Nurse's Station	300
Nursery	300
Recovery Room	150
Sterilizing Room	200
Storage Rooms	150
Treatment Room	300
Ward Corridors	200
X-Ray Room	100

Boiler room

This will be located in accordance with local fire ordinances. The boiler plant will be designed by a member of our engineering team to ensure the safety of patients and staff.

Fuel storage

The space will be allotted next to the site of generator use. The designer will maintain a space sufficient for two days stock.

Groundskeeping

A convenient room will be utilized for groundskeeping personnel and for the storage of equipment and tools for the staff in charge of landscaping and general upkeep of the garden and grounds.

Maintenance workshop

We will have a maintenance workshop for general repair of medical and nonmedical equipment. This will include an electric shop equipped with standard tools and supplies. The workshop will have adequate space for lathes, welding materials, and standard wood- and metal-working machines, as well as storage space for materials in need of repair, such as stretchers, beds, wheelchairs, portable machines and food trolleys. Since most repair work is done outside of normal working hours, space will also be provided for workers, maintenance staff, supervisory personnel and biomedical engineers.

Personnel and back-up systems are two considerations for machine maintenance in this setting. Some equipment that requires regular maintenance may necessitate on-site staff trained to fix the equipment. Other equipment may only require an occasional outside contractor in case of malfunction. All equipment should have

trained personnel within Nepal who can repair the device. Portable and common technologies may be effectively transported to Kathmandu and serviced at common repair centers.

Equipment is required for technicians to perform basic electrical medical safety tests under controlled conditions. Furthermore, these safety tests indicate whether the equipment complies with the standards set by the International Electrotechnical Commission. Since this testing equipment can be contained in a briefcase, it can be carried by the technician. A wide range of tests will be undertaken to measure insulation resistance, and continuity and leakage current in different situations (under both normal and single-fault conditions). The most common items of test equipment are provided in the equipment list.

A full technical library will be maintained at the maintenance workshop. Installation and recommended spare parts manuals, annotated with the number of the corresponding equipment, should be kept together with electronic and component data books and appropriate technical books.

Since even a very low current (in milli- or even microamperes) could be hazardous, precautions will be taken to ensure proper grounding of equipment and of conductive objects that are within the reach of the patient and attending medical staff. The electrical grounding will be maintained by our staff, and periodic checks will be made to ensure that power cords are not frayed, plugs are not damaged and there is no leakage of current within the ratings specified by the manufacturers and national standards. Medical staff will be trained to understand the need for electrical safety and some of the problems that can arise, so that they can take an active role in minimizing the potential hazards and report those that occur.

Mortuary

The mortuary facility, as is true for other district hospitals in Nepal, will be overseen by the generalist physician serving as medical director. Hospital policies and procedures are being laid down for the mortuary and for autopsies. The proper disposal of human tissues from operations and autopsies is important. The hospital staff, together with local management structures, will incinerate or bury tissues. The problem of unclaimed remains will be settled by local regulations.

The mortuary has the following functions:

- to hold dead bodies until burial can be arranged;
- to provide a place where a clinical team can investigate causes of death; and
- to allow viewing and identification of bodies by relatives and other people.

The mortuary will be accessible from wards and the emergency and operating departments. A separate access will be available for staff, relatives and undertakers.

The following areas will be designated:

- body storage;
- soiled garments holding area;
- post-mortem facilities;
- viewing room;
- visitors' waiting room;
- cleaning materials storage room;
- cleaner's room; and
- prayer and religious rites room.

Pharmacy

The pharmacy will operate from our existing pharmaceutical supply chain, government collaboration, and human resources involved in the operation of the Sanfe Bagar clinic. Our current experience with the clinic in determining the local epidemiology of disease, the demand for services, and the scope of essential medicines, will guide the initial purchases for the hospital pharmacy. The tasks of the pharmacy will include:

- safe storage and distribution of vaccines and drugs;
- maintaining adequate records for reporting and planning through the mSupply software program;
- provision of education on drugs for hospital workers and the community;
- monitoring of the cost-effective and safe use of drugs;
- provide supply of medicine to peripheral health clinics; and
- advise clinical staff on prescribing and administering therapies.

The pharmacy will be located so that it is:

- accessible to the out-patient department;
- convenient for dispensing;
- accessible to the central delivery yard; and
- manages traffic within the department.

Additional considerations for the design of the pharmacy's physical spaces include:

- Provision for security of dangerous drug ;
- Provision for control of fire;
- Bulk quantities will not be held in the pharmacy but will be drawn from a remotely located store for dangerous goods;
- Finishes will be impervious to acid and alkali and easy to clean; and
- The corridors will allow easy turning of wheeled vehicles.

Central Sterile-Supply

The central sterile-supply unit will provide sterilization for all instruments, dressings, and equipment that come into contact with patients' tissues. It will be located adjacent to the surgical services because these services demand the highest volume and most timely sterilized supplies. In addition to serving the hospital, the central sterile-supply will also supply the community health workers and peripheral health posts. Depending upon logistical demands and patient flow assessed during the first 3 months of operations, it is likely that emergency, surgery, and obstetrics will also have some internal sterilization equipment.

Medical Records

We are presently moving from a paper clinical record system to an electronic medical records that follows a few basic principles:

- the forms serve as concise, efficient cues to remind providers of the appropriate approach to patient management;.
- data recorded are easily entered and analyzable;
- data are not redundant; and
- data are useful for follow-up and continuity of care

Our clinical forms are downloadable from http://nyayahealth.pbwiki.com/Clinical_Records. We have customized the open-source PatientOS software (<http://www.patientos.org/>) for the electronic medical record that we are starting to use at both at the Sanfe Bagar Clinic and at the Bayalpata hospital.

General Staffing Needs

Well-paid, well-supported, professional staff members are the heart of clinical services. Developing and retaining an excellent administrative, maintenance, and clinical team is perhaps the single greatest challenge to achieving equity and access in global health delivery. Staff recruitment has proceeded with the open, non-political process that Nyaya has undertaken at the Sanfe Bagar clinic. At the clinic, we have successfully recruited a nearly all-Achhami staff from all political and caste backgrounds.

As at the Sanfe Bagar clinic, we are providing several key incentives and support structures that facilitate staff satisfaction and retention:

- Competitive salary with benefits;
- Opportunities for training and career advancement;
- Educational and interactive opportunities with professionals from throughout Nepal and around the world;
- Educational stipends for children; and
- Compensation for length of service.

Staff are trained and deployed in a phased manner. The table below indicates the approximate costs and time commitments of all the salaried workers operating the hospital after surgical services have been implemented, in the middle of year 2. Greater details are provided in our budget planning spreadsheets. Note that many of these workers (several of the midwives, health aides, and community health workers) will be based in their home communities, rotating through the hospital.

Staff Compensation--2010

Position	Type	Hours Per Week	Weeks Per Year	Annual Salary + Incentives (NRs)	Number	Total Costs (NRs)	Total Costs (\$)
Guard	General	45	44	48000	2	96000	\$1,500
Housekeeping Staff	General	45	44	48000	3	144000	\$2,250
Clerk	General	45	44	96000	2	192000	\$3,000
Hospital Administrator	General	45	44	600000	1	600000	\$9,375
Maintenance Staff	General	45	44	48000	3	144000	\$2,250
Health Assistant--Outpatient	Outpatient	45	44	120000	2	240000	\$3,750
Health Aide-- Outpatient	Outpatient	45	44	60000	3	180000	\$2,813
Community Health Worker	General	10	44	36000	20	720000	\$11,250
Pharmacist	General	45	44	96000	2	192000	\$3,000
Health Aide--Delivery Services	Obstetric	45	44	60000	2	120000	\$1,875
ANM Nurse Midwife	Obstetric	45	44	84000	6	420000	\$6,563
Health Assistant--Inpatient	Inpatient	45	44	120000	3	360000	\$5,625
Staff Nurse-- Inpatient	Inpatient	45	44	120000	4	480000	\$7,500
Health Aide-- Inpatient	Inpatient	45	44	60000	3	180000	\$2,813
MBBS Physician	Inpatient	45	44	840000	1	840000	\$13,125
X-Ray Technician	Radiology	45	44	120000	1	120000	\$1,875
Health aide-- Laboratory	Laboratory	45	44	60000	1	60000	\$938
Lab technician-- General	Laboratory	45	44	108000	1	108000	\$1,688
Lab technician-- Transfusion	Transfusion	45	44	132000	1	132000	\$2,063
Health aide-- Transfusion	Transfusion	45	44	60000	1	60000	\$938
Health Aide-- Operating Theater	Surgery	45	44	60000	2	120000	\$1,875
Health Assistant--Operating Theater	Surgery	45	44	120000	3	360000	\$5,625
MD-OP Physician	Surgery	45	44	1440000	1	1440000	\$22,500
Ambulance Driver/Mechanic	General	45	44	72000	1	72000	\$1,125
Food Preparer	General	45	44	36000	3	108000	\$1,688
Total Staff Compensation						7,488,000	\$117,000

Budget

The summary budget below provides an overview of the costs and revenue of our programs, broken down by services. Pharmaceutical and supply costs are based partly on our experience at Sanfe Bagar. Greater costing details can be downloaded from our wiki: <http://nyayahealth.pbwiki.com/Budget>. These costs will continue to be revised as we further our negotiations with the government, refine our planning with community members, and achieve additional sources of funding and collaborations.

Projected Capital and Operating Costs			
	2009	2010	2011
General Hospital Operations			
Renovations/Equipment/Infrastructure	\$42,868	\$10,000	\$5,000
Maintenance/Utilities/Depreciation	\$18,134	\$18,490	\$18,240
Human Resources	\$32,719	\$42,000	\$42,000
Consumable Supplies	\$3,000	\$8,000	\$8,000
<i>Sub-Total</i>	<i>\$96,720</i>	<i>\$78,490</i>	<i>\$71,240</i>
Outpatient Department			
Renovations/Equipment/Infrastructure	\$8,910	\$5,000	\$2,500
Maintenance/Depreciation	\$346	\$250	\$125
Human Resources	\$8,563	\$8,563	\$8,563
Pharmaceuticals	\$8,012	\$10,325	\$17,023
Consumable Supplies	\$1,503	\$2,581	\$4,256
<i>Sub-Total</i>	<i>\$21,333</i>	<i>\$24,719</i>	<i>\$30,467</i>
Labor and Delivery Services			
Renovations/Equipment/Infrastructure	\$11,380	\$3,000	\$2,000
Maintenance/Depreciation	\$569	\$150	\$100
Human Resources	\$8,438	\$8,438	\$8,438
Pharmaceuticals	\$306	\$831	\$976
Consumable Supplies	\$306	\$631	\$976
<i>Sub-Total</i>	<i>\$20,999</i>	<i>\$12,850</i>	<i>\$12,489</i>
Diagnostic Radiology			
Renovations/Equipment/Infrastructure	\$109,480	\$1,000	\$1,000
Maintenance/Depreciation	\$5,474	\$5,524	\$5,574
Human Resources	\$1,875	\$1,875	\$1,875
Pharmaceuticals	\$1,000	\$1,500	\$3,000
Consumable Supplies	\$200	\$500	\$800
<i>Sub-Total</i>	<i>\$118,029</i>	<i>\$10,399</i>	<i>\$12,249</i>
Diagnostic Laboratory			
Renovations/Equipment/Infrastructure	\$16,200	\$2,000	\$1,000
Maintenance/Depreciation	\$810	\$100	\$50
Human Resources	\$3,563	\$2,625	\$2,625
Pharmaceuticals	\$4,346	\$7,161	\$12,014
Consumable Supplies	\$6,519	\$10,771	\$18,021
<i>Sub-Total</i>	<i>\$31,437</i>	<i>\$22,877</i>	<i>\$33,710</i>
Inpatient Department			
Renovations/Equipment/Infrastructure	\$17,000	\$4,000	\$4,000
Maintenance/Depreciation	\$850	\$200	\$200
Human Resources	\$29,063	\$29,063	\$29,063
Pharmaceuticals	\$4,457	\$4,457	\$4,457
Consumable Supplies	\$4,457	\$4,457	\$4,457
<i>Sub-Total</i>	<i>\$55,827</i>	<i>\$42,177</i>	<i>\$42,177</i>
Blood Transfusion			
Renovations/Equipment/Infrastructure	\$16,104	\$1,000	\$2,000
Maintenance/Depreciation	\$805	\$50	\$100
Human Resources	\$2,063	\$3,000	\$3,000
Pharmaceuticals	\$3,863	\$5,687	\$7,818
Consumable Supplies	\$9,014	\$13,269	\$17,775
<i>Sub-Total</i>	<i>\$31,849</i>	<i>\$23,006</i>	<i>\$30,493</i>
Essential Surgical Services			
Renovations/Equipment/Infrastructure	\$2,608	\$15,000	\$5,000
Maintenance/Depreciation	\$130	\$750	\$250
Human Resources	\$0	\$30,000	\$30,000
Pharmaceuticals	\$0	\$7,827	\$10,754
Consumable Supplies	\$0	\$11,741	\$16,131
<i>Sub-Total</i>	<i>\$2,738</i>	<i>\$65,318</i>	<i>\$62,135</i>
Overall Total	\$378,932	\$275,636	\$294,961

Projected Revenue

	2009	2010	2011
General Hospital Operations			
In-Kind Donations- International Donors	\$0	\$0	\$0
Human Resources- Government	\$3,272	\$8,400	\$12,600
Local Community-Based Support	\$500	\$1,000	\$1,500
Outpatient Department			
In-Kind Donations- International Donors	\$2,000	\$1,000	\$1,000
Supplies & Pharma- Government	\$2,255	\$5,163	\$10,640
Human Resources- Government	\$6,544	\$12,600	\$12,600
Local Community-Based Support	\$200	\$400	\$800
Labor and Delivery Services			
In-Kind Donations- International Donors	\$3,000	\$1,000	\$1,000
Supplies & Pharma- Government	\$306	\$884	\$1,366
Human Resources- Government	\$1,688	\$2,531	\$2,531
Local Community-Based Support	\$200	\$400	\$800
Diagnostic Radiology			
In-Kind Donations- International Donors	\$104,000	\$0	\$0
Supplies & Pharma- Government	\$600	\$1,400	\$2,660
Human Resources- Government	\$375	\$563	\$563
Local Community-Based Support	\$100	\$200	\$300
Diagnostic Laboratory			
In-Kind Donations- International Donors	\$3,000	\$1,000	\$500
Supplies & Pharma- Government	\$3,259	\$8,976	\$15,017
Human Resources- Government	\$713	\$788	\$788
Local Community-Based Support	\$200	\$300	\$400
Inpatient Department			
In-Kind Donations- International Donors	\$2,000	\$1,000	\$1,000
Supplies & Pharma- Government	\$2,674	\$4,457	\$4,457
Human Resources- Government	\$5,813	\$8,719	\$8,719
Local Community-Based Support	\$500	\$750	\$1,000
Blood Transfusion			
In-Kind Donations- International Donors	\$4,000	\$1,000	\$500
Supplies & Pharma- Government	\$3,863	\$9,478	\$12,697
Human Resources- Government	\$413	\$900	\$900
Local Community-Based Support	\$200	\$500	\$800
Essential Surgical Services			
In-Kind Donations- International Donors	\$1,000	\$7,000	\$2,000
Supplies & Pharma- Government	\$0	\$7,827	\$13,443
Human Resources- Government	\$0	\$9,000	\$9,000
Local Community-Based Support	\$200	\$700	\$1,000
Total In-Kind, Government, and Community Support	\$152,873	\$97,935	\$120,580
Total International Financial Support Needs	\$226,059	\$177,701	\$174,381

Budgetary Responsibility, Effectiveness, and Transparency

Nyaya Health utilizes several strategies to maximize the social returns on our donors' investments:

- Fully transparent, line-by-line [accounting of expenditures](#).
- Empowering local community members to take ownership over services.
- Institutional policy that ex-patriate staff, consultants, and physicians will be unpaid volunteers, such that donor funds go to providing healthcare services.
- Minimal overhead in United States and Kathmandu; 99% of finances go directly to Achham.
- Epidemiological monitoring to quantify the health and social effects of our interventions.

- Developing scalable models for implementation into national policy.
- Conducting research to facilitate replication internationally.

At the same time, we minimize investment risk in the following ways:

- Developing sustainable, market-driven fundraising strategies to ensure long-term financial solvency (e.g., equityedit.org which edits medical research papers to raise funds for the clinic).
- Working with communities and government bodies to develop local capacity and ensure long-term functioning of services.
- Engaging key community and political leaders to ensure participation of all groups at a local and national level.

Nyaya Health Management Team

Bibhav Acharya, Executive Vice President. Mr. Acharya previously worked in Pokhara, his hometown, where he helped develop NGO programs for rural health workers and assisted with grant-writing and translations in HIV/AIDS programs. As a Howard Hughes Science and Society Scholar, he studied several public health programs in rural medicine and reproductive health in Bangkok and Phitsanulok in Thailand. He worked at the New York State Department of Health to research management of HIV patients with poor outcomes and helped develop indicators for the National Quality Center to measure the quality of HIV care.

Bijay Acharya, MBBS, Director of Medical Planning. Dr. Acharya is a graduate of B.P.Koirala Institute of Health Sciences, Nepal. After his graduation, he worked as a volunteer physician in an HIV Clinic run by a local NGO called Naulo Ghumti. He also worked as medical advisor for Friends of Hope, a support group for HIV infected former drug users in Pokhara. Dr. Acharya is involved in designing the clinical protocols and the medico-legal issues related with running the Achham Clinic. Starting from his high school days, he has had wide experiences in community based health care provisions in Nepal. He will be starting his residency in NY at Bronx-Lebanon Hospital in Internal Medicine.

Jason Andrews, MD, President. Dr. Andrews developed the initial vision for Nyaya Health after a trip to Achham in February, 2006 where he and his wife interviewed HIV-infected widows. Previously, Jason had established Nepal's first community based antiretroviral therapy program in Kathmandu, serving primarily injection drug users. He has studied HIV and TB in both Nepal and South Africa, and spent the last year helping to develop programs to curtail the transmission of extensively drug-resistant TB in Tugela Ferry, South Africa. He received his undergraduate training from Yale, where he stayed for his medical training, and is now a physician at the University of California, San Francisco.

Sanjay Basu, MSc, Chief Operating Officer. Mr. Basu is an epidemiologist at the Yale University School of Medicine. With Dr. Andrews and Mr. Maru, he was one of the founders of Nyaya Health. For the past nine years, he has been organizing pharmaceutical procurement mechanisms and conducted operations research for HIV and tuberculosis treatment programs in resource-denied settings. He has also served as an economic advisor for health development programs at Oxfam UK. Sanjay received his undergraduate training at MIT and his Master's degree from Oxford University, where he was a Rhodes Scholar.

Shaan Chaturvedi, MPH, Director of Public Health Planning. Mr. Chaturvedi is an infectious disease epidemiologist at the Yale School of Public Health, with a focus in international and community-based development. He has studied treatment adherence to hepatitis C therapeutics in an HIV/HCV co-infected population and has also led a project investigating schistosomiasis control in several African countries at the World Health Organization, where he was a John D. Thompson fellow. He completed his undergraduate training in Public Health at George Washington University and his MPH from Yale.

Shefali Oza, MSc, Director of Hospital Planning. Ms. Oza is an epidemiologist and biostatistician with extensive experience in international health operations planning and development. With Mr. Basu, she organized antiretroviral distribution operations at the group United Trauma Relief, and worked with Dr. Chris Murray at Harvard School of Public Health on international health service outcomes research. She has worked previously on HIV program development in India and South Africa. Ms. Oza completed her undergraduate training at MIT and her Master's degree at the London School of Hygiene and Tropical Medicine.

Duncan Smith-Rohrberg Maru, MPhil, Chief Executive Officer. Mr. Maru is an epidemiologist at the Yale School of Medicine. He oversaw the initial community surveys that formed the epidemiological foundation for

Nyaya's approach to health service delivery. He works on clinic management, fundraising, and strategic direction for the clinic. He received his undergraduate training at Harvard before coming to Yale.

Tenzing Tekan, *Clinic Director*. Mr. Tekan has worked with the World Bank and with Goldman Sachs as a financial analyst in the healthcare sector. He helped to direct funds and enhance services for numerous medical programs treating patients in India. He is working in Achham on the operational details of program management and community-based engagement. He is fluent in both Tibetan and Nepali, and develops outreach programs for the hard-to-access migrant workers from the north who speak a Tibetan dialect.

Ana Serralheiro, MSc, *Director of Logistics*. Ms. Serralheiro oversaw the deployment of the laboratory and waste management program at the Sanfe Bagar Medical Clinic. She completed her MSc. in Molecular Medicine from Cranfield University, UK. Previously, she had received her *Licenciatura* in Biotechnology Engineering from the Algarve University, Portugal.

Aditya Sharma, MD. *Director of Surgical Expansion*. Dr. Sharma is a physician who recently completed an internship in emergency medicine after receiving his medical degree from Yale. He will be living in Achham over the next year overseeing our hospital expansion.

Current Sanfe Bagar Clinic Staff

Dr. Jhapat Bahadur Thapa, MBBS, medical director. Dr. Jhapat Bahadur Thapa completed his MBBS from BPKIHS, Dharan in March 2007. Before coming to Nyaya Health, he practiced as a generalist and HIV doctor in Seti Hospital, Dhangari. He is originally from Achham, and his home is a two hours walk from the clinic in Sanfe.

Mr. Uday Chettri, health assistant. Mr. Chettri is a health assistant and pharmacist from a neighboring village to the clinic. He worked at a pharmacy for 5 years before deciding to pursue health assistant studies. Upon graduation, he started a pharmacy in the area and is now working with Nyaya to combine his pharmacy and health assistant skills. .

Santosh Shrestha, lab technician. Mr. Shrestha has a certificate degree in Medical Lab Technology. He has an exceptional background in laboratory technology and is excited to apply his skills towards further developing one of the cleanest and most comprehensive labs in Nepal.

Tara Man Kunwar, pharmacist. In addition to being a pharmacist, Mr. Kunwar is a health assistant with excellent clinical and medical knowledge. He is a student of Dr. Jhapat, and a local from Sanfe.

Gauri Sunwar, community health worker. Ms. Sunwar is a midwife with extensive community experience through her work with UNICEF in neonatal health. She is from the neighboring Bayalpata village and will be working as out Outreach Worker and also help in clinical record keeping and registration. She identifies local community health volunteers in our target villages.

Dhan Kala Kunwar, midwife assistant. Ms. Kunwar helps midwives in preparing delivery sets, handling newborns, room and equipment disinfections and autoclaving, assisting in deliveries.

Radha Kunwar, midwife. Ms. Kunwar lives in neighboring Haati Kot. She completed her on-job training after midwifery studies at Dadeldhura Team hospital. After working for one year at Dadeldhura hospital, she spent a year working as a midwife with Gangotri, a local organization providing community-based care, counseling and referral services to HIV positive patients seeking or undergoing antiretroviral therapy.

Urmila Basnet, midwife. Ms. Basnet was born in Jajarkot district and moved to Sanfe Bagar after her marriage. She spent 1 year working for the Dhankuta District Family Planning Association. She then worked for five years with a local family planning organization called Paryojana. Her work involved traveling to remote villages to dispense family planning advice, medications and immunizations primarily to pregnant women. Urmila also worked for one year providing care to HIV positive patients for Gangotri.

Sangeeta Nepali, midwife. Ms. Nepali is a nurse midwife from Sanfe and had been posted at Doti Hospital for training. Our colleague Dr. Prakash Thapa had been so impressed by her work that he created a small fund from the hospital for her. She is now starting her work with us much closer to home.

Kamala Kumari Sharma, midwife. Ms. Sharma is a resident of Bhageshwor VDC, Accham. After completing her 18-month midwife training, she began work at the Nepal government Sub Health Post in Bhageshwor VDC before arriving at Nyaya Health.

Appendices

Demographic and Epidemiologic Parameters

Demographic Characteristics

Catchment population	60,000
Proportion 0-5 years old	18%
Proportion 0-14 years old	39.7%
Proportion 15-64 years old	56.7%
Proportion 65+ years old	3.6%
Population 0-5 years old	10,800
Population 0-14 years old	23,820
Population 15-64 years old	34,020
Population 65+ years old	2,160
Females of Reproductive Age	14,970
Birth Rate (per person)	0.032
Total Fertility Rate	4.1
Annual Number of Births	1,948
Number of pregnancies	2,142
One-year olds	1,800
Five-year olds	1,800
Ten-year olds	1,489
Fifteen-year olds	1,489
Infant Mortality Rate (per 1000 live births)	64
Under-Five Mortality (per 1000 live births)	82
Maternal Mortality (per 100K live births)	740
Expected annual number of maternal deaths	14
Lifetime Risk of Maternal Mortality	3.00%
Percentage Births SGA	58%
Percentage Births Low-Weight	43%
Percentage Births Pre-Term	20%

**combining 2002 Achham/Doti survey, 2006 MoH analysis, and 2007 Nyaya survey*

Key Obstetric-Gynecological Epidemiological Parameters

Condition	Percent	Total
Deliveries performed by a skilled medical attendant	29%	613
Pregnancies requiring management of severe anaemia	2.0%	43
Pregnant women requiring treatment for syphilis	1.5%	32
Pregnant women requiring treatment of STDs other than syphilis	20.0%	428
Pregnancies requiring management of incomplete abortion	2.8%	60
Births requiring management of eclampsia	0.5%	11
Births requiring management of postpartum haemorrhage	5.0%	107
Births complicated by obstructed labor/requiring caesarean	5.0%	107
C-sections requiring transfusion	20.0%	21
Births requiring management of puerperal sepsis	8.0%	171
Babies suffering from complications	10.0%	195

**combining 2002 Achham/Doti survey and 2006 MoH analysis*

Demand for Annual Inpatient Admissions*

Incidence of admission	0.03
Days per admission	4
Total admissions	1714
Total hospital-days	6857
Beds per day (maximum)	19
Beds per day (70%)	13

Demand for Annual Outpatient Visits

patients per day	100
outpatient days per year	300
total outpatient visits	30000

Demand for Blood Transfusions

Blood Transfusions, C-Sections	21
Units per C-Section	2
Total Units, C-Sections	43
Blood Transfusions, PPH	107
Units per PPH	3
Total Units, PPH	321
Blood Transfusions, Severe Anemia	500
Units per severe anemia	3
Total Units, severe anemia	1500
Blood Transfusions, other trauma	150
Units per general trauma	2
Total units, general trauma	300
Overall Total units	2164

These numbers are based on demand, not our capacity; hence they do not vary significantly year-to-year

Existing Clinical Operations: Integration with Community Health

The limited transportation infrastructure and mountainous terrain present a challenge to the successful extension of health services to the population. In order to meet this challenge, two approaches are being taken: 1) establishing strong links to existing health posts, sub-health posts, and private medical clinics for referrals; and 2) utilization of community health workers (CHW). Both sets of health care workers represent a critical link between villages and the clinic. CHWs, in particular, can be employed in a more active role in penetrating into communities for ongoing health surveillance, in contrast to the passive model of awaiting patients to visit health institutions. Most families live in clustered villages, facilitating this model of care. CHWs are trained to recognize and refer patients with signs and symptoms of TB; identify children suffering malnutrition, acute respiratory infections and moderate-to-severe diarrhea; refer pregnant women for antenatal care; and deliver medications to HIV-infected clients. A health worker will be assigned to several villages and make twice weekly trips to each village, reporting back to the clinic on the aforementioned diseases and clients' status at weekly intervals.

Existing Services: General Outpatient Services

Scope and Scale

Our general outpatient services at Bayalpata hospital will parallel the ongoing work of the Sanfe Bagar clinic, but will offer significantly expanded capacity owing to the greater space, operating rooms and inpatient wards, enhanced laboratory, equipment availability, and broader staffing at the hospital. The organization of services will follow the strategy that has guided us from the beginning, with a core base focused on maternal, reproductive, and child health, HIV/AIDS, sexually transmitted diseases, and tuberculosis upon which we build general primary care services.

Child Health and Nutrition

In this area, the generalist physician, working together with community health workers, implements basic community-level child health interventions. The client-level interventions follow the Integrated Management of Childhood Illness (IMCI) model [7-9], including the following components:

- Treatment of pneumonia, with appropriate use of antibiotic and bronchodilators;
- Management of diarrheal diseases with low-osmolarity Oral Rehydration Solution and use of antibiotics for bloody diarrhea;
- Evaluation and expansion of vaccination programs and Vitamin A supplementation;
- Screening and treatment of helminthic infections with albendazole and mebendazole;

- Promotion of breast feeding where appropriate (a separate protocol for HIV-positive mothers has been established based on the Partners in Health management guidelines, and is available on our website);
- Screening and treatment of micronutrient deficiencies;
- Screening and treatment of failure to thrive/macronutrient deficiencies;
- Treatment of otitis media with appropriate antibiotic use; and
- Management of pediatric fever, with evaluation and management of malaria, meningitis, measles, and other infectious processes.

These relatively simple, low-tech strategies are implemented by a CHW-centered team approach to reduce malnutrition and child mortality in this area.

The community health workers are being trained from the Integrated Child Development Services model whereby CHWs engage individual families in the following core activities:

- Malnutrition evaluation, provision of supplementary feeding, and referral of acute malnutrition cases;
- Regular height and weight monitoring;
- Education and engagement of families and communities in nutrition and health support for young children;
- Scheduling and check-up of routine vaccinations and well-baby and well-child visits; and
- Engagement in non-formal pre-school educational activities.

Although the preceding interventions are rightly focused on preventing the bulk of the excess mortality that children face during the under-five years, additional attention will be paid to several important facets of children in the five to fifteen age group, namely:

- Appropriate antibiotic treatment of group A streptococcal pharyngitis, with the aim of decreasing the prevalence of Rheumatic Heart Disease, which remains the primary cause of cardiovascular mortality and morbidity in Nepal;
- Continued micronutrient screening and treatment through adolescence; and
- Screening and treatment of anemia and helminthic infections.

The expansion of these programs after the first year of operation will be dictated by community needs and epidemiological realities, though we imagine that the primary direction of growth will be expanding the geographical reach of the model, and providing more sophisticated medical services to meet the needs of more complex pediatric conditions.

Existing Services: HIV and Sexually Transmitted Infections

A comprehensive care program for HIV/AIDS is being instituted, based upon the “four pillars” model of Partners in Health (PIH):

- HIV prevention and care, including voluntary counseling and testing, treatment and prevention of opportunistic infections, and antiretroviral therapy;
- tuberculosis detection and treatment through directly observed therapy (see tuberculosis section);
- women’s health, reproductive health, and prevention of mother-to-child HIV transmission (see maternal health section); and
- detection and treatment of sexually-transmitted diseases.

Our program recognizes the importance of integrating voluntary counseling and testing for HIV into primary care services to improve detection and provide a tighter continuum of care. HIV clinical care is also provided, including prophylaxis and treatment of opportunistic infections and antiretroviral therapy with medicines supplied by the government. Community health workers and treatment supporters are involved in the oversight of therapy, providing both adherence support and early detection of drug toxicities and new opportunistic infections. Low cost CD4 enumeration technologies continue to emerge across the world, and we are currently pursuing several avenues to access these once they become available. The absence of this laboratory parameter, however, has not precluded the provision of antiretroviral therapy; experiences in Haiti and elsewhere have well demonstrated the ability to successfully initiate and monitor therapy through clinical signs, with the aid of absolute lymphocyte counts.

Existing Services: Tuberculosis

This program works within the existing directly-observed therapy, short-course (DOTS) providers to expand services and appropriately provide linkage to other care services. Additionally, a major goal will be to integrate HIV and TB services. The following specific programs will be implemented:

- Screening and referral of suspected TB clients:

- Acid-fast bacilli (AFB) sputa for symptomatic clients who are unable to get such services from a DOTS center;
- Limited number of chest radiography for AFB-negative clients with high clinical suspicion for pulmonary TB;
- Treatment of active TB:
 - Working with DOTS centers to improve the care of extrapulmonary TB using standard isoniazid-rifampin-pyrazinamide-ethambutol (streptomycin) regimens;
 - Working with DOTS centers to improve the care of treatment failure and drug resistant TB clients, and expanding access to DOTS-Plus and second-line regimens;
- Integration with HIV activities:
 - Routine referral of TB clients to voluntary counseling and testing;
 - Routine evaluation of HIV+ clients for tuberculosis and consideration for treatment of latent TB;
 - Surveillance of HIV among TB clients;
 - Treatment of active TB among HIV+ patients, including dual ART-ATT when indicated;
- Linkage to external labs for sputum culture and sensitivity; and
- Community-based active case finding.

Existing Services: Delivery Services

Here, we describe the services provided for routine, normal delivery. These services parallel current activities at the Sanfe Bagar clinic. Emergency obstetrics is described in the essential surgical services section of this document. The medical services in the clinic are provided by a physician with obstetric experience together with midwives, nurses and community health workers. Traditional midwives are trained and, in some cases, hired. For home deliveries, midwives are being trained in safe delivery and use of PATH's clean home delivery kit [10].

The routine delivery program includes:

- Prenatal evaluation of anemia and provision of folic acid and iron, vaccination with tetanus toxoid, anti-helminth treatment with albendazole, and macronutrients, where necessary;
- Routine prenatal check-ups;
- Routine delivery attended by trained midwives or doctor;
- Promotion and support of immediate postpartum breastfeeding when appropriate; and
- PMTCT program with routine antenatal HIV testing.

As we do presently at the Sanfe Bagar clinic, we will follow the model of the “Averting Maternal Death and Disability” (AMDD) program [11-13] for providing the “basic” package of emergency obstetric care for routine non-surgical deliveries including:

- Intravenous and oral antibiotics for perinatal infections;
- Intravenous and oral Oxytocin;
- Intravenous and oral anticonvulsants for perinatal seizures;
- Removal of retained products of conception;
- Manual removal of placenta; and
- Assisted vaginal delivery.

General gynecological services are also provided, which, along with the primary care and perinatal services, should provide comprehensive care to female clients

- STD screening and treatment;
- Treatment of urinary tract infections;
- Evaluation of menstrual irregularities;
- Evaluation and treatment of uterine and bladder prolapse; and
- Regular screening for cervical cancer through camps and telemedicine-based Pap smear pathology readings.

These essential services, provided at a regional level by the physician, will complement the services provided by trained midwives and community health worker at a more local level. Ultimately, midwives will be hired to cover each of the major geopolitical locales in the district. These midwives will provide the following basic services:

- Prenatal evaluation of anemia and provision of folic acid and iron, vaccination with tetanus toxoid, and macronutrients, where necessary;
- Routine prenatal check-ups;
- Routine delivery attended by trained midwives or doctor;
- Promotion and support of immediate postpartum breastfeeding when appropriate;

- Recognition of obstetrical emergencies and referral to central clinic;
- Referral for HIV voluntary counseling and testing and, if necessary, administrative of antiretrovirals to prevent the transmission of HIV from mother to child; and
- Screening and referral of common gynecological conditions.

The key components for the prevention of mother-to-child transmission (PMTCT) intervention are as follows:

- Routine HIV voluntary counseling and testing to all pregnant women;
- Treatment with antiretroviral therapy for HIV-positive women meeting World Health Organization criteria, currently being less than 200 CD4+ T lymphocytes per milliliter or the presence of a Stage II AIDS-defining illness. Additionally, the infants of antiretroviral-treated mothers will receive one week of liquid zidovudine with or without single dose of liquid nevirapine; and
- For those HIV-positive pregnant women not presently needing antiretroviral therapy, there will be several options available to the mother, though the primary regimen will likely include zidovudine from 28 weeks gestation plus single-dose nevirapine at labor for the mother, and one week of liquid zidovudine plus single-dose liquid nevirapine for the infant.

Common Diseases Treated by Overall Nyaya Health Services

The following is a general listing of some of the common conditions that are managed by the comprehensive hospital, clinic, and community services provided by Nyaya Health.

Acute Trauma and Emergency

Anaphylaxis
 Cardiac arrest—ABC resuscitation
 Cardiac arrest—defibrillator
 Bites and rabies
 Burns
 Natural disasters
 Head injury—stabilization and referral
 Multiple injuries
 Pneumothorax/hemothorax
 Poisoning
 Shock
 Emergency tracheotomy
 Fluid resuscitation
 Abdominal trauma/acute abdomen—initial assessment, stabilization and referral
 Electrolyte imbalance—initial assessment and treatment

HIV/AIDS and STDs

PMTCT
 Voluntary counseling and testing for HIV
 HIV screening and confirmation
 Staging of AIDS and antiretroviral treatment
 Gonorrhea/urethral discharge
 Female genital discharge
 Female dysuria
 Pelvic inflammatory disease
 Genital ulcer disease
 Swollen inguinal glands
 Genital warts

Cardiovascular Conditions

Congenital heart disease
 Deep venous thrombosis
 Heart failureHypertension
 Pulmonary edema
 Ischemic heart disease—initial treatment
 Rheumatic heart disease

Central nervous system

Cerebral palsy
Seizure disorders

Dental and oral conditions

Abscess, periapical
Acute necrotizing ulcerative gingivitis
Cellulitis, oral
Detection of oral neoplasms for referral
Pericoronitis
Periodontitis
Pulpitis
Alveolitis, dry-socket—evaluation and referral
Jaw trauma—stabilization and referral
Temporomandibular joint disorders—evaluation and referral

Ear, nose, throat conditions

Acute otitis media
Otitis externa
Epistaxis
Foreign body, nose
Foreign body, ear
Wax extraction, ear
Chronic otitis media—evaluation and referral

Endocrine

Diabetes Mellitus
Hypothyroid

Ocular Conditions

Trachoma
Cataracts—referral and camps
Ocular trauma
Conjunctivitis
Glaucoma

Family Planning

Hormonal contraceptives
Intrauterine contraceptive devices
Condoms, female
Condoms, male
Vasectomy
Tubal ligation
Rhythm methods

Gastrointestinal conditions

Amoebiasis
Cholera
Helminthic Infections
Gastritis
Diarrheal diseases
Peptic ulcer disease
Upper GI bleed—referral

Gynecology

Vaginitis
Pelvic inflammatory disease
Infertility—basic level assessment and treatment
Uterous fibromyoma—referral/camps
Gynecological neoplasms—referral

Uterine prolapse—referral/camps
Fistulae—referral/camps
Sexual assault
Pelvic masses
Menstrual disturbances

Infectious Diseases

Acute rheumatic fever
Measles
Malaria (typically imported)
Meningitis
Poliomyelitis
Tetanus
Tuberculosis
Typhoid fever
Rabies
Viral hemorrhagic fevers
Surveillance of emerging infectious diseases

Mental Illness

Acute psychosis
Anxiety
Depression
Bipolar disorder
Schizophrenia
Suicidal Ideation
Substance abuse
Post-traumatic stress syndrome

Musculoskeletal Conditions

Arthralgias
Gout
Osteoarthritis
Rheumatoid Arthritis
Septic Arthritis—initial management/referral

Neonatal Care

Routine care of newborn
Neonatal asphyxia and resuscitation
Birth injuries
Congenital anomalies
Jaundice
Preterm infancy
Apneic attacks
Respiratory distress

Nutritional and hematological conditions

Anemia
Blood transfusions
Failure to thrive
Growth monitoring
Protein-Calorie Malnutrition—Acute
Protein-Calorie Malnutrition—Chronic
Micronutrient deficiencies

Obstetrics

Antenatal care
High-risk pregnancy
Anemia in pregnancy

Antepartum hemorrhage
Gestational and pregestational diabetes
Multiple gestations
Pre-eclampsia/Eclampsia
Rhesus incompatibility
Urinary tract infections
Ectopic pregnancy
Normal delivery
Uterine rupture
C-Section delivery
Postnatal care
Complications of puerperium
Postpartum hemorrhage
Puerperal infections
Mastitis
Deep vein thrombosis
Breastfeeding education
Incomplete abortion and complications
Abortion care

Orthopedics

Closed fractures and dislocations
Supracondylar displaced fractures
Compartment syndrome
Soft tissue and crush injuries
Spinal vertebrae trauma/fracture—stabilization and referral
Pelvic fracture—stabilization and referral
Hip joint dislocation
Acute osteomyelitis
Chronic osteomyelitis—assessment and referral
Pyogenic septic arthritis
Tuberculosis of bones and joints
Gout arthritis
Rheumatoid arthritis
Congenital bone diseases
Amputations
Scoliosis

Respiratory System—Upper Tract

Common cold
Pharyngitis
Pharyngotonsillitis/tonsillitis
Sore throat
Sinusitis

Respiratory System—Lower Tract

Difficulty breathing in children
Pneumonias
Acute epiglottitis
Croup
Acute bronchitis
Asthma-related conditions
Chronic obstructive pulmonary disease

Dermatological Conditions

Atopic dermatitis
Impetigo
Ringworm
Scabies

Herpes zoster
Superficial abscesses, cysts, tumors

Renal Conditions

Urinary tract infections
Acute glomerulonephritis
Acute renal failure—stabilization and initial assessment
Chronic renal failure—stabilization and referral
Hypokalemia
Nephrotic Syndrome

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The primary text used in developing this document:

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<http://www.wpro.who.int/internet/files/pub/297/toc.pdf>

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Note that this is a planning document, and not an academic one. As such, several pieces of the text are paraphrased or directly quoted from the above references, particularly, "District Health Facilities: Guidelines for Development and Operations".