Capacity building of public health laboratories in Afghanistan: challenges and successes (2007–2011)

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بناء القدرات في مختبرات الصحة العمومية في أفغانستان: التحديات والنجاحات (2007-2011)

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الخلاصة: إن حالة الصراع المتواصل وما ينجم عنه من تدمير للبنية الأساسية قد جعلت أفغانستان عرضة بشكل كبير لأوبئة الأمراض. وتعمد هذه الورقة إلى عرض ما طرحته الوحدة الثالثة للبحوث الطبية للبحرية الأمريكية من مبادرات لتعزيز بناء القدرات في عدد من المختبرات الطبية الأساسية، ولتمكين الأفغان من اكتشاف الأمراض الناشئة والمنبعثة والتي تمثل أهمية للصحة العمومية. فالمعدات والإمدادات وتدريب العاملين في المختبرات تعد من الأمور الأساسية في تشخيص الأمراض، والوفاء بالالتزامات بموجب اللوائح الصحية الدولية 2005. ومن ثم فقد تم مؤخراً اكتشاف العديد من فاشيات الأمراض بما فيها أنفلونزا الطيور والأنفلونزا الجائحية، والأمراض الحمَّوية، والإسهال المائي، واليرقان، وداء الليشمانيات. وقد تم تجميع العينات السريرية ونواقل الأمراض بغرض تحليلها. وتم كذلك الحصول على المستفردات الميكروبية للتعرف بشكل أكبر على المزيد من خصائصها. وقد ساعد توسيع نطاق الإجراءات المختبرية وتعزيز دقتها، مختبرات محلية معينة على رصد واكتشاف وتحديد وتقييم واحتواء المخاطر التي تهدد الصحة العمومية ومجابهتها. ومع هذا فإن السياسات الخاصة بالاستدامة ومكافحة الأمراض المعدية بحاجة إلى مواصلة الدعم والتأكيد.

ABSTRACT The continuing state of conflict and the resulting devastation of infrastructure have made Afghanistan exceptionally vulnerable to disease epidemics. The paper reports initiatives by the United States Naval Medical Research Unit No. 3 to promote capacity building in a number of key medical laboratories and enable the Afghans to detect emerging and re-emerging diseases of public health importance. Equipment, supplies and laboratory staff training were critical for disease diagnosis and fulfilment of obligations of the International Health Regulations 2005. Accordingly, many diseases outbreaks were recently identified, including avian and pandemic influenza, febrile illness, watery diarrhoea, jaundice and leishmaniasis. Clinical samples and disease vectors were collected for analysis, and microbial isolates were obtained for further characterization. The expanded range and enhanced accuracy of laboratory procedures have facilitated selected local laboratories to monitor, detect, identify, assess, contain and respond to public health threats. Nevertheless, policies of sustainability and infectious diseases control need continuous support and emphasis.

Renforcement des capacités des laboratoires de santé publique en Afghanistan : défis et succès (2007–2011)

RÉSUMÉ La persistance du conflit ainsi que la destruction des infrastructures qui en résulte ont rendu l'Afghanistan exceptionnellement vulnérable aux épidémies. Le présent travail de recherche détaille les initiatives de l'Unité de recherche médicale de la marine des États-Unis d'Amérique (NAMRU-3) visant à promouvoir le renforcement des capacités de plusieurs laboratoires médicaux clés et à permettre aux Afghans de dépister des maladies émergentes et réémergentes qui sont importantes sur le plan de la santé publique. Les équipements, les fournitures et la formation du personnel de laboratoire étaient critiques pour le diagnostic des maladies et le respect des obligations découlant du Règlement sanitaire international (2005). En conséquence, de nombreuses flambées épidémiques ont récemment été identifiées, notamment les grippes aviaire et pandémique, les maladies fébriles, les diarrhées aqueuses, l'ictère et la leishmaniose. Des échantillons cliniques ainsi que des vecteurs de maladie ont été collectés pour analyse, et des isolats microbiens ont été obtenus pour affiner la caractérisation. L'éventail élargi et la précision accrue des procédures de laboratoire ont permis aux laboratoires locaux sélectionnés de suivre, de dépister, d'identifier, d'évaluer, d'endiguer les menaces de santé publique et d'y répondre. Toutefois, les politiques visant à assurer la pérennité de ces capacités et la lutte contre les maladies infectieuses nécessitent un appui et un effort permanents.

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Introduction

Ongoing military conflicts and political instability in Afghanistan [1] have resulted in an unstable and fragile governance, and weak health-care infrastructure and concerns over personal safety have impeded most public health programmes. In rural districts where most of the population lives, there are severe limitations in manpower and the placement of experienced health-care workers and supplies. Dilapidated water supplies and distribution systems, poor sewage disposal systems and pollution of the Amu Darya river have contributed significantly to the spread of diarrhoea and other infectious diseases [2,3]. While respiratory diseases prevail during the extreme climate in winter, disease vectors flourish in the warmer summer months [4].

To help the Afghans maintain stability and security, the global community recognized that despite the challenges massive humanitarian demands must be adequately fulfilled. The local government established the Afghanistan National Development Strategy in 2005 to function as a roadmap for joint action between the government and donors [5]. Plans to re-establish the clinics and hospitals that had been destroyed, reduce the exodus of health-care workers, increase incomes and allow adequate government investment and training opportunities were described by the Afghan Ministry of Public Health (MoPH) in the 2005 Basic Package of Health Services and the 2005–06 National Health Strategy [6].

In 2007, the United States Naval Medical Research Unit No. 3 (NAMRU-3) was requested by MoPH to assist with rebuilding the country's laboratory capacity and improving current syndromic disease surveillance systems based on its earlier collaborations in tick collection, vector identification and human immunodeficiency virus research [7–10]. In this paper, we describe the methods used by NAMRU-3 in strengthening laboratory capacity building in Kabul and outlying regions. The mutual objectives were: to promote medical laboratory capacity building in a number of key laboratories; and to enable the Afghans to detect emerging and re-emerging diseases of public health importance for a better, timely and accurate management and enhancement of the quality of life of the Afghan people.

Methods

Approach strategies

In an agreement with the Afghanistan Public Health Institute (APHI), the MoPH was formulated to upgrade disease diagnosis capacities in a systematic manner at selected sentinel sites including the Central Public Health Laboratory (CPHL), Kabul Infectious Diseases Hospital, Indira Gandhi Paediatric Hospital and Afghanistan National Army Hospital. Regional hospital laboratories serving Kandahar (Merwas Hospital), Helmand and Uruzgon provinces were also included. This effort was initiated and maintained from 2007 to 2011.

Assessment and upgrading of infrastructure

An assessment plan, with a focus on human capital, infrastructure, management and training needs, was adopted to identify defects and problems. A strategy for space remodelling and renovations was executed at CPHL to accommodate new equipment and allow expansion of diagnostic capabilities to include facilities for clean cell culture, virus isolation and molecular analyses. Some minor changes were also made in the other laboratories as needed. NAMRU-3 procured laboratory equipment (Table 1) and shipped them mainly through the services of United States military air command flights. Trucks and cars were contracted within the country to deliver the supplies and equipment. Because of security and travel constraints, provincial hospitals were only enabled to perform simple and sustainable methods, such as bacterial culture and serology by enzyme-linked immunoassays (ELISA) for the detection of various disease-causing pathogens. Supplies and reagents were provided with sufficient quantities whenever possible, given the travel limitations and difficulty of shipping to a land-locked country under conflict. Biological materials requiring cold-chain were hand carried with escorts, observing the packing and shipping regulations of the International Air Transport Association.

Enhancement of disease diagnosis under the diseases early warning system

A number of laboratory-based disease surveillance and research protocols addressing major priority and vaccine-preventable diseases were established by NAMRU-3 (Table 2). These were implemented in coordination with the World Health Organization (WHO) to meet the goals of the MoPH disease early-warning system for the diagnosis of the etiologies of a spectrum of acute diarrhoeal infections, acute febrile illness such as typhoid, brucellosis, dengue, Crimean–Congo haemorrhagic fever and malaria, influenza and influenza-like illnesses and leishmaniasis. These protocols were approved by the science and ethical review boards of MoPH and NAMRU-3. Partnership with WHO comprised the sharing of data during surveillance and emergence of outbreaks to improve output and enhance response plans. Contact with the Central Veterinary Disease Research Laboratory, Ministry of Agriculture, Irrigation and Livestock, Food and Agriculture Organization, United States Agency for International Development (USAID) and the Global Emerging Infections Surveillance and Response System was also conducted as needed.

Table 1 Programmes supported (in full or in part) by United States Naval Medical Research Unit No. 3 for surveillance of common infectious disease syndromes in Afghanistan

Programme title	Objectives
Spectrum of disease survey and enhanced surveillance for acute febrile illness (AFI) and acute diarrhoeal infections (ADI)	• Establish capacity for infectious disease surveillance in selected hospitals • Determine etiologies of pathogens causing AFI and/or ADI • Describe epidemiological characteristics and associated risk factors
Regional influenza and influenza-like illness surveillance	• Support regional information system network in Middle East • Capacity building (training, equipment, supplies)
Seroprevalence and risk factors for Crimean–Congo hemorrhagic fever (CCHF) in rural districts of Herat province	• Estimate seroprevalence of CCHF in humans and livestock • Identify risk factors for historical zoonotic infections • Identify potential primary CCHF vector in Afghanistan
Prevalence and etiological agents of visceral leishmaniasis (VL) in Baghlan	• Estimate seroprevalence of VL and identify possible risk factors • Identify infectious agent of VL in northern Afghanistan
Outbreak investigation of hepatitis B virus (HBV) in Laghman	• Identify and control sources of HBV infection through a case–control study
Assessment of putative risk factors and behaviours for hepatic venoocclusive disease outbreak, Gulran District, Herat	• Identify factors associated with hepatic venoocclusive disease
Community-based cross-sectional study of prevalence of helminthic infection, anaemia and malnutrition in children ages 6 months through 12 years in Afghanistan	• Determine prevalence of helminthic infection from a cross-sectional study • Estimate proportions having helminthic disease-associated anaemia • Determine nutritional Z-scores of pre-school age children with helminthic versus non-helminthic infections
Temporospatial distribution of spectrum of AFI and diarrhoea in infants age 0–2 years in Kabul	• Enhance diagnostic facilities at Maiwand Hospital • Use the enhanced capability to investigate the spectrum of diseases • Establish a sustainable surveillance system for AFI and ADI
Suspected anthrax outbreak investigation in Nimroz Province	• Identify causative agent and putative risk factors for outbreak in Nimroz Province (later confirmed as plague)
Antimalarial drug sensitivity surveillance	• Estimate baseline frequency of mutations associated with antifolate resistance and detect differences in mutation frequency of Plasmodium falciparum

Establishment of referral policies

To ensure quality measures, CPHL acted as a reference laboratory for confirming all disease outbreaks reported by the regional laboratories. Also, 10% of the samples received at the peripheral laboratories were shipped regularly to CPHL for evaluation as an internal quality control measure. Pathogenic isolates and laboratory results from acute diarrhoeal infections, acute febrile illness, influenza-like illnesses and leishmaniasis studies were received at NAMRU-3 for confirmation and further analysis. Also, NAMRU-3 formed a team of trained epidemiologists and laboratory professionals hired from Afghanistan and Europe and stationed in Kabul to evaluate the performance indicators and progress of each project on a regular basis. In compliance with NAMRU-3 guidance, this local workforce was in close contact with other regional teams and travelled during outbreaks to offer immediate professional support.

Training

A total of 300 laboratory sessions for 140 trainees from different sites were conducted during this activity to evade the risk of so-called brain-drain that typically happens under conflict in resource-limited countries. This training process involved also training-the-trainers, with a total of 76 days of internal training achieved for 236 Afghan health-care workers using materials and concepts acquired through NAMRU-3. In the laboratories, several staff, including 40 technicians, 4 field epidemiologists and about 10 support staff, were recruited and trained extensively at NAMRU-3 to perform their respective diagnostic procedures following standard operating procedures. This Kabul-based team was in close contact with monitors in the other provinces and travelled during outbreaks to offer immediate advice, kits and supplies after communication with NAMRU-3. They also provided subject matter experts' views and assistance to MoPH for emergency preparedness and control of diseases. For feasibility reasons, previous training materials provided by other collaborators were updated and harmonized with those of NAMRU-3, and translated into Dari and Pashto local languages. Training plans included basic and advanced bacteriology, serology, clean cell culture, virus isolation and identification, molecular biology and biomedical equipment preventive maintenance and calibration. Sessions on biorisk and biosafety, public health principles, ethics in research (according to Collaborative Institutional Training Initiative) and laboratory quality

Table 2 Sample of equipment and supplies provided for collaborating laboratories in Afghanistan

Item	No. of items	Site
PCR machine, conventional	1	CPHL
PCR machine, real-time	2	CPHL
Gel documentation apparatus, digital camera	1	CPHL
ELISA (washer and reader)	6	All sites
Regular microscope	6	All sites
Inverted microscope	2	CPHL
pH meter	6	All sites
Class II biosafety cabinets	4	CPHL, Indira Gandhi Paediatric Hospital, Kandahar
Centrifuge /swing bucket/multipurpose	6	All sites
Ultralow freezers	3	CPHL, Kandahar
Water bath	6	All sites
Refrigerator	6	All sites
Sterilizer	6	All sites
Incubator (with/without CO_2)	6	All sites
Vortex mixer	6	All sites
Ultra pure water system	6	All sites
Fire extinguisher	6	All sites
Digital balance	4	CPHL, Indira Gandhi Paediatric Hospital, Kandahar
Air clean zone	2	CPHL
Hot plate and magnetic stirrer	6	All sites
Computer/printer	6	All sites
Anaerobic jar	12	All sites
Single/multiple channel pipette	> 10	All sites
Blood culture bottles	> 800	All sites

PCR = polymerase chain reaction; ELISA = enzyme-linked immunosorbent assay; CPHL= Central Public Health Laboratory.

management systems were provided at levels that exceeded the minimum requirements of the WHO 2005 International Health Regulations [11].

Evaluation of quality performance indicators

Superior performance was maintained by monitoring quality indicators—recovery rates of isolation, contamination, turnaround time for reporting, quarterly proficiency tests on bacterial reference strains and recovery of cell cultures from frozen cell stocks, systems for recording events and activities, e.g. log books, worksheets, test algorithms and flow charts, sample rejection criteria, number of samples repeated and illegible handwriting—were introduced. Tools for periodic calibration of micropipettes, pH meters, CO_2 pressure in cell-culture incubators, recording of temperatures and humidity, maintaining water baths, and use of quality control tests for both virological and bacteriological media were instituted and reviewed. Proper procedures for sharps disposal, double-glove technique, disinfection of bench surfaces, use of personal protective equipment, prohibiting mouth pipetting and safe centrifugation practice were incorporated into the standard operating procedures as an enhanced trend of routine practice.

Results and Discussion

As a result of a complex assessment process that utilized assessment standard criteria, several areas of weakness and causes of unsatisfactory performance and inadequate quality of data were identified. These included: poor English language skills; limited scientific knowledge; inadequate professional awareness of good laboratory practices; improper utilization of space; need for more laboratory space; lack of reliable utilities, deficiencies in key tools and equipment; and the presence of stocks of non-functional equipment. These challenges were surmounted by immediate plans for remodelling available spaces, surveying old and non-functional tools and enrolling the promising local staff members in private local courses to improve their language and relevant knowledge.

Training on laboratory functions was designed to cover a wide range of required tasks. Approved research protocols (Table 2) were presented, explained and discussed with all the involved teams at laboratories, hospitals and the field. Sessions were made to address each component of the respective protocol. As part of an educational enhancement, these sessions were performed in a professional manner, allowing staff to enquire and interact. Proper case definition and proper sample collection, handling, processing and analysis, data entry and reporting were major areas of focus and interest. The expanded awareness resulted in building self-confidence and a better ability to understand and perform public health research and surveillance, which extended to NAMRU-3 enhancement initiatives and those of other collaborators and donors, directly and indirectly.

Disease early warning system

The disease early warning system was launched in 2006 in only 8 provinces with a limited number of surveillance sites. It covers a list of priority diseases, including mainly vaccine-preventable diseases, acute respiratory infections/influenza-like illness, acute watery diarrhoea, bloody diarrhoea/acute watery diarrhoea with dehydration, acute viral hepatitis, malaria and meningitis/severely ill children. The number of the currently functional reporting sites has increased from 123 in year 2007 to 344 by end of March 2013 and the frequencies of medical consultations have become more common, thanks to NAMRU-3 expanded training initiatives and close coordination with MoPH, WHO and USAID.

Influenza surveillance and influenza-like illness

As the performance of both field and laboratory staff has been upgraded, the number of samples and recovered viral isolates increased, many seasonal influenza isolates (H1N1 and H3N2) are regularly shipped to NAMRU-3 and the Centers for Disease Control and Prevention (CDC) in Atlanta for confirmation and strain surveillance studies.

As the avian influenza outbreak progressed globally, both the Afghan Central Veterinary Disease Research Laboratory and CPHL received about 1200 avian swabs in response to multiple avian influenza outbreaks. The newly introduced capacity of molecular analysis of reverse transcription-polymerase chain reaction was utilized and resulted in the confirmation of the H5N1 virus. Although more than 12 million chickens are reared in Afghanistan, the majority (98%) are raised in house backyards and fed on scraps, with little or no proper husbandry. However, only a few hundred birds were infected with H5N1 and no outbreaks had been reported from the commercial facilities [12]. Education of owners and breeders on the safe handling of birds, restriction of movement and importation bans were set to prevent virus transmission. Measures were also taken to cull the poultry within a 3 km radius. Intensive surveillance was conducted, and fortunately no human cases were reported.

Likewise, in response to the emerging threat of pandemic swine influenza-like virus, this enhanced capacity enabled CPHL to process more than 800 nasopharyngeal swabs, of which 456 were from locals and the rest were from non-Afghans, with a death toll of 11 [13]. Meanwhile, a state of emergency was declared. Although most cases were mild, MoPH distributed antiviral medicine to 34 Kabul hospitals and clinics, enough for about 50 000 cases [13]. Confirmation of influenza viruses at both NAMRU-3 and CDC has qualified CPHL to be recognized by the WHO as the Afghanistan national influenza centre.

Acute febrile illness

The enhanced capacities of serology laboratories at CPHL and regions enabled the MoPH to respond to and report multiple outbreak events. In the fall of 2008 a haemorrhagic fever outbreak occurred in Herat in western Afghanistan, with 60 suspected cases, and IgM of Crimean–Congo haemorrhagic fever was identified in 6 of them as later confirmed at NAMRU-3. Furthermore, a cross-sectional serosurvey in humans and livestock was established and IgG for Crimean–Congo haemorrhagic fever was detected in 37/330 patients (11%), 72/92 (79%) in cattle and 30/40 (75%) in sheep [14]. Fortunately Crimean–Congo hemorrhagic fever virus was not detected in a collection of 259 *Hyalomma marginatum* ticks, although other victors are being screened. However, further serological evidence of vector-borne acute febrile illness including Crimean–Congo haemorrhagic fever, hantavirus, sandfly fever virus infections (Sicilian and Naples) and rickettsial diseases has been reported [15].

Moreover, through enhanced diagnostics at CPHL, WHO was able to announce the detection of Q-fever and brucellosis in 147 individuals in Bamyan province in 2011 [16]. Earlier, 3 other outbreaks of brucellosis had been reported from Punjab district in 2007 and 2008, but none were detected in 2009 and 2010 [16]. In addition, a total of 900 serum samples were collected by CPHL and assayed at NAMRU-3 for flavivirus etiologies among acute febrile illness patients. Immunoglobulin G (IgG) for tick-borne encephalitis, dengue and West Nile virus was detected in 214, 180 and 277 samples respectively, while IgM was detected in 20, 8 and 5 samples respectively [Elyan DS, American Society for Microbiology meeting, 2011].

An outbreak of typhoid fever was confirmed from central Ghor province in 2007 [17] and most cases were diagnosed by Widal test. Our update serosurveillance has supported the evidence of both typhoid fever and brucellosis as the leading bacterial etiologies of febrile illness in Afghanistan [Elyan DS, in preparation, 2013]. Reports have shown that 50%–70% of the Afghans live in extreme poverty with a lack of clean water and significant health vulnerability to enteric diseases [18]. Patients and their contacts were instructed to use clean or boiled water for drinking, to wash and cook vegetables thoroughly and avoid contact with infected animals or their uncooked products.

Acute watery diarrhoea

Our capacity-building initiatives have also enabled health officials to diagnose and assess diarrhoea in patients seeking health care at the hospitals. Accordingly, the bacteriology laboratory at CPHL has identified *Vibrio cholera* [19] as well as other pathogenic Enterobacteriaceae as a routine practice. These isolates were shared with NAMRU-3 for confirmation and further characterization. As part of the laboratory-based surveillance, about 700 stools samples were

collected and processed at different laboratories in Kabul and some regional sites for non-bacterial microbial etiologies of diarrhoea. It was demonstrated that rotavirus (56%, single or mixed infections) and *Cryptosporidium* spp. (15%, single and mixed infections) are important leading causes of diarrhoea [Elyan DS, American Society for Microbiology meeting, 2012].

Prevalence data for viral hepatitis is apparently limited in Afghanistan; nevertheless, the enhanced diagnostic capacity has updated serological indicators and showed that both hepatitis B and E virus are endemic [20; personal communication with CPHL].

Medical entomology and vector-borne diseases

A widespread assessment together with sporadic reports have shown that malaria is endemic in eastern Afghanistan and many other parts of the country [15], with nearly 14 million people living at risk [20] due to ineffective vector control, damaged dwellings, formation of new mosquito breeding sites, movement of populations and lack of personal protection. Therefore major capacity-building efforts were conducted in medical entomology and vector biology. Several training workshops in medical entomology surveillance and identification of disease-vectors were administered for the technical staff at the Afghan national malaria and leishmania control programmes. As a result, about 20 CDC light traps baited with CO_2 were regularly placed in leishmaniasis- and malaria-endemic areas in Kabul and its surroundings. This has enabled the Afghan technicians to routinely collect and identify hundreds of mosquitoes using up-to-date taxonomic keys. The most prevalent malaria vector species were *Anopheles stephensi, A. culicifacies, A. pulcherrimus* and *A. superpictus*. Our surveillance on blood smears was in agreement with other studies, stressing that nearly 3 million malaria cases are likely to occur annually, mostly due to *Plasmodium falciparum* and *P. vivax*. Therefore, reduction of insect breeding sites and use of insecticide spraying have been recommended as a local public health measures. Bednets, top sheets and cloth window screens were also advocated to protect against insect bites. Since 1986, both *Plasmodium* spp. have acquired resistance to chloroquines, largely due to therapeutic pressure of related drugs [21]. Dry blood spots were sent to NAMRU-3 and PCR technology was deployed to confirm drug resistance. This confirmed that both sporozoites have acquired resistance to chloroquines.

Concerning leishmaniasis, Kabul has been regarded as the largest focus of anthroponotic cutaneous leishmaniasis globally, with active *Leishmania* spp. lesions or scars being found on 2.7% and 21.9% of inhabitants respectively [22]. There were 65 000 cutaneous leishmaniasis cases in 2009 and a similar number in 2010 [22]. However, only a small number of visceral leishmaniasis cases were reported in 2004 [23]. To assess sandfly species diversity and abundance and identify potential vector(s) of cutaneous and visceral leishmaniasis, more than 7000 sandflies representing 29 species were collected and studied. Of these, 14 were *Phlebotomus* spp., including 5 confirmed vectors of cutaneous and or visceral leishmaniasis; *P. papatasi, P. sergenti, P. alexandri, P. langiductus* and *P. major*. The remaining 15 species were *Sergentomyia* spp. *P. sergenti,* a vector of anthroponotic cutaneous leishmaniasis (*L. tropica*), made up the majority of the catch (81%) relative to the other *Phlebotomus* spp.. Moreover, *P. papatasi,* the primary vector of cutaneous leishmaniasis (*L. major*) comprised about 9% of the capture, while *P. keshishiani,* a possible vector of visceral leishmaniasis, comprised 7%. When more than 200 pools containing 660 female flies were tested for *Leishmania* spp., 8 pools were positive for *L. tropica*. The results suggest that *P. sergenti* is the primary vector of *L. tropica* in Kabul city. However, the detection of *Leishmania* DNA in *P. papatasi* and *P. keshishiani* suggests that more than one vector may be responsible for the transmission of *L. tropica* in this region. Prevention measures included limiting sandfly bite exposure, rodent control and residual insecticide spraying are highly recommended.

Conclusion

NAMRU-3 developed strategic plans in collaboration with MoPH and WHO to upgrade and support disease diagnosis capacities at 6 key sentinel sites. Within a few months, assessments were made, materials delivered, on-site training conducted, laboratory capacity established and laboratory-based disease surveillance was supported and maintained. Mechanisms for temporary hiring were adopted by NAMRU-3 for integrating suitable spaces and workforce into the laboratory systems to overcome the net losses of destruction, attrition and emigration.

Enhanced diagnostic capabilities supported the Diseases of Early Warning System and the areas of respiratory, vector-borne, acute febrile and diarrhoeal infections. CPHL and collaborating hospitals were able to receive and analyse samples using a wider range of standard and accurate tests. Quality performance indicators have been established and maintained, and attending physicians have reportedly confirmed a greater level of confidence in laboratory information. Public health decision-makers acknowledged a greater availability of quality data to make key judgments. Along the same line, CPHL has been designated by WHO as a national reference centre for a number of infectious diseases and has shown extensive interactions with the global community and CDC. This fulfilled an essential part of the WHO International Health Regulations (2005) requirements and demonstrated a huge leap in monitoring the burden of infectious

diseases and in revitalizing hospital-based care. Along with improved vaccination programmes, mortality trends in very young age groups in Afghanistan, globally known to be among the highest worldwide, were reduced from 257/1000 in 2002 to 191/1000 in 2008. Furthermore, the Afghanistan Mortality Survey 2010 showed a further reduction to 97/1000 in 2010. A rough indicator of health status that may best show an improvement in the quality of life of Afghans is that life expectancy, which during the 1990s was only 42 years, had risen to 61 years in 2011 [18].

While laboratory capacity building had significant spillover effects in other sectors and allowed the population to develop the sense of a more optimistic future, it also reflected on neighbouring countries that were unable to monitor and respond to infectious diseases within their borders and put them at lower risk. An important future direction is to assist the MoPH build a new National Public Health Laboratory (NPHL), given the observation that the present CPHL is relatively small and has a limited impact on remote areas where a majority of the population lives. The MoPH is planning for the NPHL to become the national reference laboratory and for the current CPHL to become the Kabul regional laboratory. A building site has already been identified, architectural plans developed and money currently earmarked for donation by the United States Department of Defense.

One immense challenge that remains is to be able to provide highly qualified trained laboratory professionals to staff the NPHL, CPHL and other institutions. The available pool of well-qualified laboratory professionals remains small. The MoPH should seek scholarships to send promising laboratory professionals abroad to pursue undergraduate and graduate level education. It is also reasonable to use the existing training pipelines to upgrade the local curricula of the faculties to train more skilled biologists. In addition, the MoPH laboratory sector should continue to require logistic support for supplies and equipment. Expertise should be sought to train Afghan medical logisticians to support the MoPH and its national laboratories to create and update inventories and implement an efficient supply distribution management system.

Finally, sincere commitment, government political resolve and competitive and transparent mechanisms should be maintained to achieve economic growth, resource development and better health for all. Further, the role of global and regional efforts in supporting and sustaining the diagnosis and control of infectious diseases should not be curtailed or overlooked.

We strongly believe that the MoPH in Afghanistan will maintain this enhanced capacity and will exert all mandated efforts to continue to secure maximum support to enable sustainment of the changes.

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