



**Europe and Central Asia Region
and
Global HIV/AIDS Program, World Bank**

**Blood Services in Central Asian Health Systems:
*A Clear and Present Danger of Spreading HIV/AIDS
and Other Infectious Diseases***



May 2008

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**BLOOD SERVICES IN CENTRAL ASIAN HEALTH
SYSTEMS:**

***A CLEAR AND PRESENT DANGER OF SPREADING
HIV/AIDS AND OTHER INFECTIOUS DISEASES***

Europe and Central Asia Region Human Development Unit
and Central Asia Country Management Unit
The World Bank

in collaboration with U.S. CDC/CAR, USAID and WHO-EURO

Global HIV/AIDS Program, World Bank

May 2008

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Correspondence on this report should be sent to Patricio Marquez (pmarquez@worldbank.org)

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N. Usmanova, Epidemiologist, CDC/CAR

A. Dzhumagulova, Epidemiologist, CDC/CAR

B. Zhusupov, Epidemiologist and Task Team Leader, CDC/CAR

T. Kalashnikova, Deputy Director in Charge of Laboratory System Issues, CDC/CAR

S. Adjeilat, Epidemiologist, CDC/CAR

A. Turgunbaieva, Trainee, CDC/CAR

T. Ismagulova, Trainee, CDC/CAR

N. Kovtunenکو, Director, Reference Laboratory, Republican AIDS Center, Kazakhstan

S. Vasilieva, Director, Reference Laboratory, Republican AIDS Center, Kazakhstan

Z. Iskakova, Director, Enzymoimmunoassay Laboratory, Oblast Blood Center, Kazakhstan

N. Babina, Head of Epidemiological Department, Oblast AIDS Center, Kazakhstan

T. Kutukeiev, Chief of the Disease Prevention Department, Ministry of Health, Kyrgyz Republic

T. Kuchuk, Director, Quality Control Laboratory, Kyrgyz Republic

N. Golovchenko, Director, AIDS Center Laboratory, Kyrgyz Republic

E. Musabaiev, Director, Viral Hepatitis Laboratory, Uzbekistan

Y. Mustafaieva, Researcher, Reference Laboratory, Uzbekistan

V. Bokhivadinoв, Director, Republican Blood Center, Tajikistan

M. El-Nageh, Executive Director, International Consortium for Blood Safety, New York Blood Center, New York, United States

F. Ala, Director, National Blood Service, West Midlands Region, and World Health Organization Collaborating Centre for Training and Development in Blood Transfusion, Birmingham, United Kingdom

Janiet Merza Niquir, Director, National Blood Center, Jordan

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ABBREVIATIONS

ADB	Asian Development Bank
AIDS	Acquired Immune Deficiency Syndrome
ALT	Alanine Aminotrasferase; ALT tests detect liver damage
ARV	Antiretroviral Drugs (used for treating HIV/AIDS patients)
CAR	Central Asia Region
CDC	United States Centers for Disease Control and Prevention
DALYs	Disability-Adjusted Life Years
EIA	Enzyomo-Immuno-Assay
EQA	External Quality Assessment Program
EuroHIV	European Centre for the Epidemiological Monitoring of AIDS
FFP	Fresh Frozen Plasma
FSU	Former Soviet Union
GDP	Gross Domestic Product
GNI	Gross National Income
HBV	Hepatitis B Virus
HBsAg	Hepatitis B Surface Antigen
HCV	Hepatitis C Virus
HIV	Human Immunodeficiency Virus
ICBS	International Consortium for Blood Safety
IDU	Injecting Drug Use
IDUs	Injecting Drug Users
MDGs	Millennium Development Goals
MOH	Ministry of Health
MSM	Men Who Have Sex with Men
PAHO/WHO	Pan American Health Organization/World Health Organization
PLHIV	People living with HIV (includes people living with AIDS)
RAIDS	Republican AIDS Centers
RPR	Rapid Plasma Reagent
SANEPID	State Committee on Sanitary and Epidemiological Inspection
SGHS	Second-Generation HIV Surveillance
STI	Sexually Transmitted Infection
TB	Tuberculosis
UNAIDS	Joint United Nations Program on AIDS
UNDP	United Nations Development Program
USAID	United States Agency for International Development
VDRL	Venereal Disease Research Laboratory
WHO	World Health Organization
WHO/EURO	World Health Organization Regional Office for Europe

Blood Services in Central Asian Health Systems: A Clear and Present Danger of Spreading HIV/AIDS and Other Infectious Diseases

EXECUTIVE SUMMARY

Understanding how communicable diseases spread is key to controlling them. Blood transfusions are a small contributor to communicable disease transmission compared to other well-reported modes, but ensuring the safety of the blood supply in a health system is largely within the purview of national governments.

Until recently, little was known about blood transfusion systems in Central Asia and their contribution to disease transmission. The World Bank and the Central Asian Regional Office of the United States Centers for Disease Control and Prevention (CDC/CAR) collaborated to shed light on the workings of these systems. With the permission and collaboration of the Central Asian countries' Ministries of Health, and under a co-financing arrangement with the World Bank, CDC/CAR re-screened blood samples from 7,500 blood donors in Central Asian countries in 2007. These re-screenings revealed the risk that contaminated blood may be reaching health facilities for administration to unsuspecting patients by unsuspecting doctors. *This is alarming given that transfusion of HIV-infected blood is the most efficient means of transmission: about 100 times more efficient than intravenous drug injection with a contaminated syringe (according to available evidence, risk of HIV transmission through blood transfusion is 9,250 per 10,000 exposures to an infected source).*

The report discusses inter-related parts of blood transfusions systems, and presents an overview of the parts that need to be strengthened in Central Asia. Numerous parts are in serious need of organizational restructuring, new investment and increased budgetary support for operation and maintenance. This report sets them out such that each can be addressed in turn – and some simultaneously. The report also discusses the health threat posed by alarmingly low levels of blood supplies, fostered by a culture that places little value on donating blood, public fear of being infected by giving blood, and the near absence of donor promotion campaigns.

Evaluating communicable diseases rates in blood donors is essential for monitoring the safety of the blood supply and donor screening effectiveness. *This assessment found that the current screening for blood borne pathogens of donated blood in Central Asia may be providing a false sense of security -- the risk of receiving an infected blood unit and acquiring a transfusion-transmitted infection in the countries of the region is real. More ominous is the fact that some health facilities in Central Asia do not test blood donations at all. This means that the transmission risks indicated in this study may be conservative estimates, as they are based on a sample that excludes the blood that never reaches the existing screening system.*

The blood sample re-testing identified cases of HIV that had been undetected by the blood center laboratories that originally tested these samples. These cases included HIV-infected blood units that reached health facilities; other units found positive for viral hepatitis B and C had been discarded. *The re-testing found prevalence of communicable diseases in the blood samples to be 0.20 percent for HIV, 2.7 percent for hepatitis B, 3.0 percent for hepatitis C, and 3.6 percent for syphilis. ALT tests were also performed as back-up check for the potential “window” infection stage (when markers for the disease could not be detected. Elevated ALT is a “red flag for liver*

dysfunction, generated by viral infections, drug or alcohol abuse). A prevalence of 8.6 percent for ALT elevation was found, signaling potential residual risk of transmission of viral diseases during the window stage. These findings underscore the need to strengthen screening of blood donors on the occasion of each donation and other prevention and control measures to guarantee the safety of the blood supply in the health systems of the Central Asia countries, and reduce the risk of involuntary infection to the unsuspecting population. The information generated by this assessment may serve as an initial baseline for future assessments.

Results disaggregated by country are not presented due to their sensitive nature, but they were conveyed by the CDC/CAR team to high-level authorities of the Ministries of Health in the participating countries as soon as they became available in 2007, as was done in past years with the results of related assessments. The Ministries' early response was to adopt several measures with the support of international organizations, as follows:

- Legal and regulatory measures have been issued and adopted in some countries.
- Blood centers that did not use questionnaires to identify behavioral risk factors among potential donors are now starting to use them.
- New laboratory equipment has been installed in two republican blood centers.
- Blood centers that used re-usable vials have started using disposable bags; they are also using more-reliable test-kits.
- Training workshops have been organized on blood safety for laboratory quality control, blood safety for epidemiologists, and blood banking and use for medical personnel. Also, full courses have been conducted in these countries for epidemiologists and blood service specialists.
- Additionally, national guidelines on the use of blood are now being revised.

Further improvements are recommended in this report, including revising policies and national level coordination of blood services, shifting to 100 percent unpaid blood donors, implementing blood donation campaigns, creating related information systems and standardized databases on blood donors and donated blood, raising budgets for blood transfusion services, improving infrastructure and equipment and related materials, developing centralized procurement systems and guidelines for procurement, ensuring that blood and its products are used rationally, implementing quality assurance and control systems within all parts of the blood transfusion service, and improving communication and collaboration at the regional level.

Controlling blood transmitted communicable diseases and ensuring appropriate blood supplies are key public health issues in Central Asia. Ensuring blood supply safety, however, is a particularly difficult challenge in countries with a low national income level and weak health care systems. As argued here and fully consistent with the health improvement and poverty alleviation objectives of World Bank work in the health sector, efforts to address the systemic deficiency of blood transfusion services in Central Asia should be part of broader health system strengthening programs and activities that need to be supported by national governments and the international community. It is expected therefore that this report will contribute to advance health system reforms in Central Asia and beyond.

PREFACE

A recent United Nations Development Program (UNDP) study concluded that the spread of communicable diseases is one of the most critical health problems facing Central Asia, and that unless action is taken, the toll of HIV/AIDS and Tuberculosis alone will seriously further compromise the region's economic and social well-being.¹ Unsafe blood transfusions and medical practices may contribute, and in some cases have already contributed, to the spread of communicable diseases, particularly HIV, hepatitis B and C,² and syphilis.³ Blood supply shortages are also a concern, as reported herein.

This report provides an overview of the challenge posed by the deteriorated blood transfusion services in Central Asian health systems, a situation that presents a clear and present danger to the populations of these countries. The results of a 2007 assessment conducted by the Central Asia Regional Office of the United States Centers for Disease Control and Prevention (CDC/CAR), under a co-financing arrangement with the World Bank, are discussed. In addition, the World Bank team took into account the technical recommendations put forward in this field by the World Health Organization (WHO) and the Joint United Nations Program on AIDS (UNAIDS), and reviewed other published and unpublished sources, including online sources, contributing to the evaluation of the CDC/CAR evidence.

Efforts to identify and document systemic deficiencies of blood transfusion services in Central Asia are fully consistent with the Bank's health improvement and poverty alleviation objectives in the health sector.⁴ Indeed, well organized and well financed health systems are necessary to ensure equitable access to effective health care services. These efforts are also consistent with the new strategic directions guiding the Bank's overall work,⁵ particularly those of fostering

¹ UNDP, Central Asia Human Development Report 2005: Bringing Down Barriers: Regional Cooperation for Human Development and Human Security (New York: UNDP, 2006).

² Hepatitis is characterized by the presence of inflammatory cells in liver tissue. It can be self-healing or progress to scarring of the liver. Hepatitis is acute when it lasts less than six months and chronic when it persists longer. The patient becomes unwell and symptomatic when the disease impairs liver functions that include, among other things, screening of harmful substances, regulation of blood composition, and production of bile to help digestion. Hepatitis B is transmitted through blood transfusion, tattoos, sexual intercourse, contact with body fluids, or from mother to child by breast feeding (minimal evidence of transplacental crossing). However, in about half of cases the source of infection cannot be determined. Contact with infected blood can occur by sharing syringes in intravenous drug use, shaving accessories such as razor blades, or touching wounds on infected persons. Hepatitis C is transmitted through contact with infected blood (including through sexual contact where the two parties' blood is mixed) and can also cross the placenta. Hepatitis C may lead to a chronic form of hepatitis, culminating in cirrhosis. (Division of Viral Hepatitis, CDC, <http://www.cdc.gov/ncidod/diseases/hepatitis/> accessed on March 3, 2008).

³ Syphilis is a venereal disease, characterized by acute infection with a primary lesion and secondary eruption involving skin and mucous membranes, and a chronic phase that may extend for decades with long periods of latency, and late lesions of skin, bone, viscera, and central nervous and cardiovascular systems. It may be transmitted to the fetus. (D. L. Heymann, ed., *Control of Communicable Diseases Manual*, 18th Edition Washington, DC: American Public Health Association, 2004, and R.Oelrichs, personal communication, April 15, 2008).

⁴ World Bank, Healthy Development: The World Bank Strategy for Health, Nutrition & Population Results (Washington, DC: World Bank, 2007).

⁵ R. B. Zoellick, Catalyzing the Future: An Inclusive and Sustainable Globalization, Address to the Board of Governors (Washington, DC: October 22, 2007).

regional and global public goods that transcend national boundaries and of working in close cooperation with other agencies that have special expertise.

This is an initial attempt to collect empirical evidence on and evaluate the functioning of blood transfusion services in Central Asia. Information concerning these services in most former Soviet Union (FSU) countries generally remains unavailable. The evaluation was performed only after the CDC/CAR and World Bank teams gained permission from the governments to retest blood samples for markers of blood-transmitted infections and agreed to engage national specialists in the effort. Furthermore, the assessment of the safety of blood transfusion services in Central Asia is preliminary. Further research is needed to more precisely hone this understanding and to support the informed implementation of related policy and institutional reforms. Nevertheless, the need to act on the basis of available evidence is urgent. This report should foster continued efforts to improve these services.

In fact, as country-specific findings became available during the course of its 2007 investigation, as was done in previous investigations in 2004 and 2005, the CDC/CAR team shared them with high-level authorities of the Ministries of Health of the assessed countries. Initial measures addressed some of the more urgent and readily corrected problems. Thus, one of the main objectives of this work – raising awareness at the highest government level of the nature of problems in the blood services and fostering action to address them with the support of the international community – began to be met before the drafting of this report.

How this report is organized

To explain the results of the CDC/CAR investigation and their implications for policy making and action, the report begins by providing information on the growing burden of communicable diseases in Central Asia, particularly HIV/AIDS. Next are discussions on the importance of safe blood transfusion services and practices. The state of these services in Central Asia is then described, followed by recommendations.

It is expected that the results of this assessment will help the governments of the Central Asian countries develop measures necessary to prevent the transmission of communicable diseases, particularly HIV/AIDS, hepatitis B and C, and syphilis, due to contaminated blood and blood products administered in the health care system. It is also intended to help mobilize international support to help the countries in this region block this source of communicable disease transmission as part of broader health system restructuring efforts.

CHAPTER I: THE BURDEN OF COMMUNICABLE DISEASES

A. Background

The Central Asia region countries -- Kazakhstan, the Kyrgyz Republic, Tajikistan, Turkmenistan, and Uzbekistan -- include more than 60 million ethnically, culturally, and religiously diverse people distributed over a geographical area twice the size of continental Europe. Located at the center of the Eurasian continent, these landlocked countries, which became independent when the Soviet Union dissolved in 1991, comprise one of the poorest regions of the world. The 2004 Gross National Income (GNI) per capita varied from a low US\$270 in Tajikistan, US\$400 in the Kyrgyz Republic, US\$470 in Uzbekistan, to US\$2,270 in Kazakhstan. Shrouded for decades from public knowledge, these countries recently became the focus of international attention due to their geopolitical importance and long-term economic potential, including from large hydrocarbon reserves and other natural resources.

Newly emerged and re-emerging communicable diseases threaten the entire global community and extract a heavy human, economic, and social toll on parts of it.^{6,7} Communicable diseases (also known as “infectious diseases”) are each caused by a specific infectious agent or its toxic products that arise through transmission of that agent or its products from an infected person, animal, or inanimate source to a susceptible host, either directly or indirectly through an intermediate plant or animal host, vector, or the inanimate environment.⁸ Agents that enter the body through intravenous (by vein) or intramuscular (by muscle) means are referred to as “parenteral.”

Accounting for more than 13 million deaths a year – one death in two in developing countries – communicable diseases are among the world’s biggest killer of children and young adults.⁹ About 32 percent of all deaths worldwide are caused by communicable diseases, maternal and perinatal conditions and nutritional deficiencies.^{10 11} Almost 90 percent of these deaths are caused by pneumonia, tuberculosis (TB), diarrheal diseases, malaria, measles, and the human immunodeficiency virus (HIV). HIV infection can lead to acquired immune deficiency syndrome (AIDS), rendering the victim unable to fend off “opportunistic infections” (such as TB and pneumonia). Sexually transmitted infections (STIs) can facilitate transmission of HIV and TB. Communicable diseases are leading causes of ill health and disability worldwide, and ill health due to communicable diseases is strongly associated with poverty.

⁶ A. S. Fauci, “Infectious Diseases: Considerations for the 21st Century,” *Clinical Infectious Diseases* 32 (2001): 675–85.

⁷ WHO, *Macroeconomics and Health: Investing in Health for Economic Development* (Geneva: WHO Commission on Macroeconomics and Health, 2001).

⁸ Heymann, *Control of Communicable Diseases Manual*, (2004).

⁹ WHO, *Removing Obstacles to Healthy Development* (Geneva: WHO, 1999).

¹⁰ A.D. Lopez, et al, “Global and regional burden of disease and risk factors, 2001: systematic analysis of population health data,” *The Lancet* 367 (2006):1747-1757.

¹¹ WHO, *The World Health Report 2004* (Geneva: WHO, 2005).

New opportunities for the spread of communicable diseases have arisen from accelerating trade, travel, and migration;¹² climate change will exacerbate the situation. The spread of communicable diseases has been linked to global security:¹³

- Highly prevalent communicable diseases have the potential to sicken and kill a significant portion of a country's population and could be particularly ominous for economies if they affect workers in key sectors of the economy (e.g., mining, manufacturing, agriculture) and military personnel.
- Outbreaks of disease or even the perceived threat of an outbreak can have significant repercussions on trade and travel for affected nations; overall economic effects of endemic diseases such as malaria can be significant.
- Significant social and governmental disruptions can be caused by fear and anxiety over disease threats.
- Bioterrorism risks raise the importance of communicable diseases to a global imperative.

The growing global attention to the prevention and control of communicable diseases is demonstrated by the fact they dominate the public health agenda of world leaders (e.g., meetings of the Group of Eight countries,¹⁴ and the Davos Economic Forum); international agencies (e.g., WHO, the World Bank; the Global Fund to Fight AIDS, TB and Malaria; the United States President's Emergency Plan for AIDS Relief [PEPFAR]; and philanthropies (e.g., the Gates and Google Foundations).

B. Communicable diseases in Central Asia

1. Overview

In 2002, the population of the Europe and Central Asia region lost an estimated total of 150.3 million disability-adjusted life years (DALYs);¹⁵ communicable diseases accounted for 9 percent—a little over half of which is related to HIV and TB, external causes of injury and poisoning for 14 percent, and noncommunicable diseases for 77 percent of the total.¹⁶ However, given the short time-lag between exposure and occurrence, communicable disease epidemics can develop very fast with the potential of endangering the health of large populations across countries. Knowledge, attitudes, and practices related to prevention of communicable diseases

¹² D. L. Heymann, "Evolving Infectious Disease Threats to National and Global Security," in L. Chen, J. Leaning, and V. Narasimhan, eds., *Global Health Challenges for Human Security* (Cambridge, MA: Harvard University Press, 2003), 105–23.

¹³ G. Cecchine, and M. Moore, *Infectious Disease and National Security: Strategic Information Needs* (Santa Monica, CA: RAND Corporation, 2006).

¹⁴ G-8: Canada, France, Germany, Italy, Japan, the Russian Federation, the United Kingdom and the United States

¹⁵ DALYs express years of life lost to premature death and years lived with a disability of specified severity and duration.

¹⁶ WHO-EURO, *The European Health Report 2005. Public Health Action for Healthier Children and Populations* (Copenhagen: WHO-EURO, 2005).

among population groups most at risk and health care personnel in Central Asian countries are lower than in other FSU and Eastern European countries.¹⁷

The importance of communicable diseases remains great in Central Asia due to:¹⁸

- a growing TB epidemic, including multi-drug-resistant TB spreading from prisoners to the general population;¹⁹ growing rates of HIV incidence related to increased drug use; and a high prevalence of STIs;
- endemic viral hepatitis, both B and C;
- a continuing threat from other, mainly epidemic-prone, diseases: (i) water-borne diseases, such as diarrheal diseases, hepatitis A, and typhoid fever; and (ii) vector-borne diseases such as malaria, which has re-emerged in Tajikistan and in the south of the Kyrgyz Republic and has the potential to spread throughout Central Asia; and
- emerging threats, such as Avian Influenza or SARS.

The factors that increase the risk of communicable disease outbreaks and epidemics in Central Asia include:

- high poverty levels in some countries,
- relatively poor access to basic water and sanitation services,
- underfunded and inefficient public health services,
- deteriorated health care infrastructure and medical equipment,
- weak public health laboratory networks,
- limited human resources bases in the health systems,
- poor quality health services, including the unsafe use of blood and its products and unsafe injections in medical settings, and
- local health systems that fail to use epidemiological information for decision-making and provide little feedback to those who collect data and issue reports using such data²⁰ (significant manipulation of communicable disease data occurs in these countries: some disease cases are never reported, and even outbreaks of special pathogens have been controlled without reporting).

¹⁷ WHO European Observatory on Health Care Systems, “Health Care in Central Asia, *Policy Brief* (Brussels: WHO, 2003), accessed at <http://www.euro.who.int/document/obs/carbrief120202.pdf> on March 1, 2008.

¹⁸ P. V. Marquez et al., “Communicable Diseases: A Perpetual Challenge in Central Asia, *Strategy Note* (Washington, DC: World Bank, 2006).

¹⁹ WHO/IUATLD, “Anti-Tuberculosis Drug Resistance in the World, Report No. 4, The WHO/IUATLD Global Project on Anti-Tuberculosis Drug Resistance Surveillance (Geneva: WHO, 2008).

²⁰ World Bank, *Epidemiologic Surveillance Systems in Eastern Europe and Central Asia: An Overview* (Washington, DC: World Bank, 2004).

2. HIV/AIDS in Central Asia

Globally, HIV is the fourth leading cause of the burden of disease. Central Asia is experiencing four overlapping epidemics—drug use, HIV, STIs, and TB.²¹ This region’s HIV epidemic is concentrated, affecting less than 1 percent of adults, but even so, about 90,000 people are estimated to have the virus. The driver of the HIV epidemic in Central Asia is injecting drug use. Other modes of HIV transmission include unprotected sexual relations and mother-to-child perinatal transmission. Transfusions of infected blood or its products and nosocomial infection are other important modes of HIV transmission in Central Asia. These countries also have some of the highest incidence rates of TB and multi-drug-resistant TB in the Europe and Central Asia region. TB/HIV co-infection is associated with higher morbidity and mortality and increased TB transmission among the general population.

Box 1 describes the stage of the HIV/AIDS epidemic by country.

Box 1: The HIV Epidemic in Four Central Asian Countries, 2007

Uzbekistan: This country has about 30,000 HIV cases -- the largest number in Central Asia. HIV is spreading most rapidly among the country’s 100,000 IDUs; other at-risk groups include prisoners (about 100,000), sex workers (about 20,000), and men who have sex with men (MSM) (about 15,000). The number of newly reported HIV diagnoses rose exponentially between 1999 and 2006: from 28 to 2205. Almost one in three (30 percent) IDUs tested HIV positive in a 2003–2004 study in Tashkent, the nation’s capital.

Kazakhstan: About 15,000 people are estimated to have HIV. The country has a fast-growing, IDU-driven epidemic: 74 percent of all HIV cases are due to IDU (130,000). Newly registered HIV cases increased between 2004 and 2006 from 699 to 1745, attributed in part to expanded HIV testing (in correctional settings, among most at-risk groups, and among pregnant women). A 2005 study in Temirtau found 17 percent of IDUs to be HIV-positive. Sentinel surveillance in 23 towns and cities in 2005 indicated that a little more than 3 percent of IDUs nationally were infected with HIV. A nosocomial* HIV outbreak that infected more than 130 children in the Shymkent region was reported in 2006.

Tajikistan: More than 10,000 people are estimated to be infected with HIV. Prevalence among IDUs increased between 2005 and 2006 from 16 percent to 24 percent in the cities of Dushanbe and Khujand. Also of concern is the sudden rise in prevalence among sex workers in those cities (from 0.7 percent to 3.7 percent over the same period).

Kyrgyz Republic: Estimates indicate that more than 4,500 people have HIV. The epidemic is concentrated largely among IDUs. Sentinel surveys in Bishkek and Osh in 2006 found HIV prevalence of 0.8 percent among IDUs, 3.5 percent among prisoners, 1.3 percent among female sex workers, and 1 percent among MSM.

Source: Adapted from UNAIDS 2007 AIDS Epidemic Update. Geneva: UNAIDS, 2007.

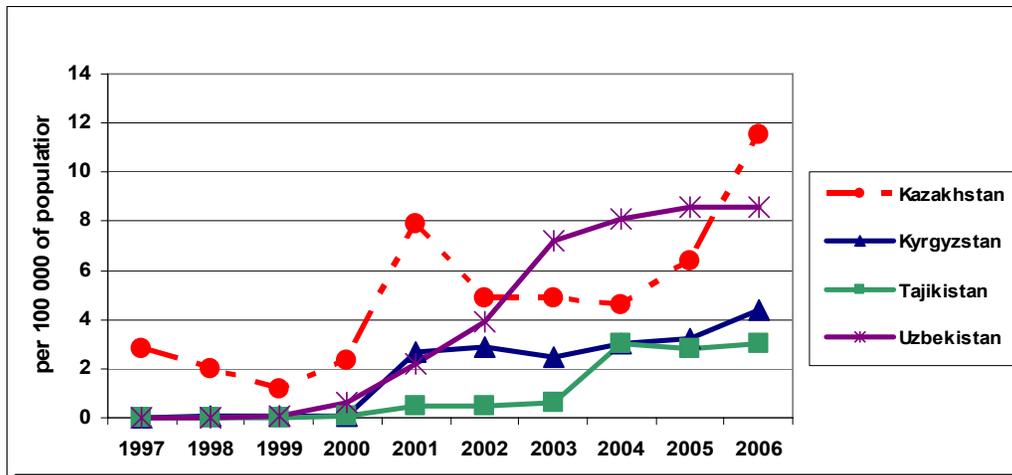
* Nosocomial infections are those that result from treatment in a health care facility and are secondary to the patient’s original condition. Infections are considered nosocomial if they first appear at least 48 hours after admission or within 30 days of discharge (Source: Wikipedia Free Encyclopedia).

Straddling major drug-trafficking routes, Uzbekistan’s epidemic is driven by increasing prevalence among injection drug users (IDUs); this group reports low rates of condom use,

²¹ World Bank, Project Appraisal Document on a Proposed IDA Grant in the Amount of SDR 16.2 Million (US\$25.00 Million Equivalent) to the Central Asia Cooperation Organization for a Central Asia AIDS Control Project (Washington, DC: World Bank, 2005).

raising both the risk of sexual transmission to partners and the likelihood that the epidemic will bridge to the general public. Much smaller epidemics are under way in the Kyrgyz Republic and Tajikistan, but the incidence of HIV in Central Asia has grown in recent years (Figure 1). A contributing cause is the increased heroine and opium trade since the 2001 start of military conflict in Afghanistan, which triggered a rapid growth in drug use. Drug trafficking and injecting drug use (IDU) are increasing throughout Central Asia, especially along the Northern Corridor between Afghanistan and Russia.^{22,23} Most of the estimated 500,000 drug users share needles, exposing them to the risk of contracting HIV, as well as other blood borne infections.

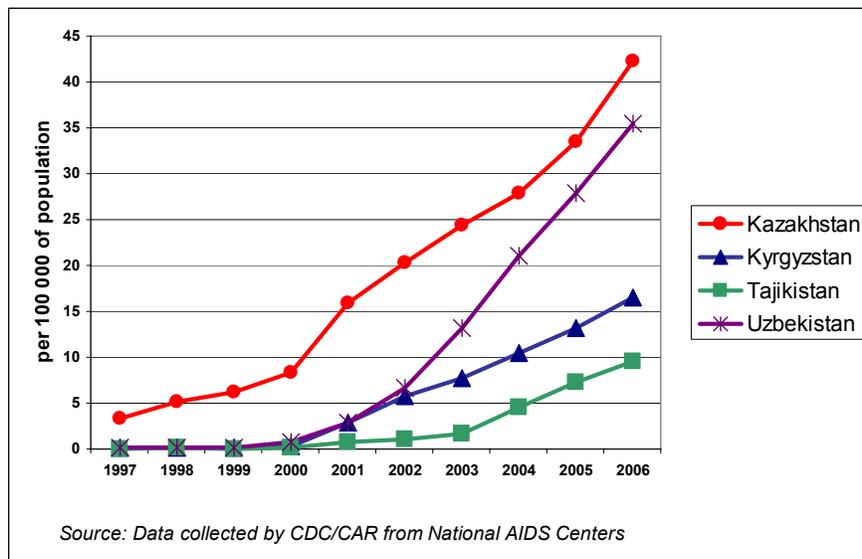
Figure 1. Registered HIV cases/100,000 pop., four Central Asian countries, 1997–2006



Source: Data collected by CDC/CAR from National AIDS Centers.

Figure 2 shows the cumulative number of registered HIV cases since 1997. Over 2001–2006, total HIV cases registered in the four countries increased two to six-fold.

Figure 2. Cumulative HIV registration/100,000 pop., four Central Asian countries 1997–2006

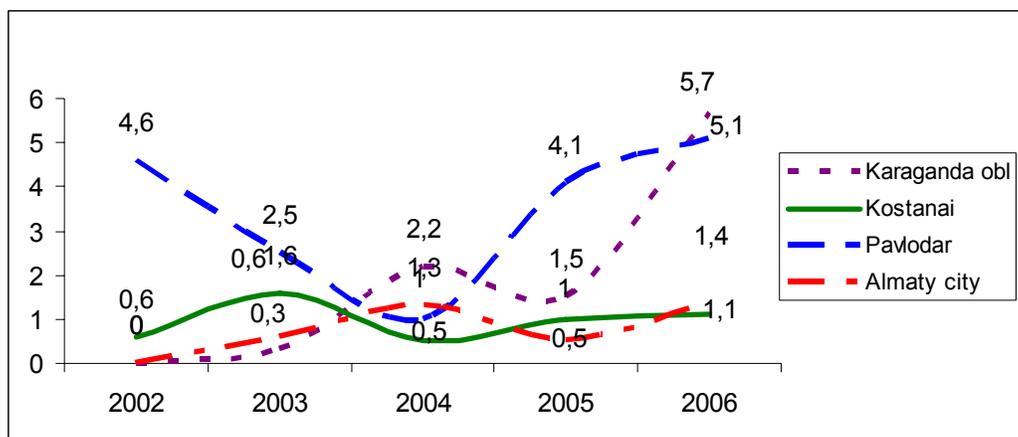


²² UNAIDS/WHO, AIDS Epidemic Update (Geneva: UNAIDS/WHO, December 2006).

²³ J. Godinho et al., HIV/AIDS and Tuberculosis in Central Asia (Washington, DC: World Bank).

Blood donors are increasingly infected with HIV in Central Asia. In Kazakhstan, for example, their HIV prevalence rate (i.e., cumulative total) increased in 2002-2006 from 0.03 percent to 0.8 percent (Figure 3). Similarly, in Uzbekistan, the number of blood-transmitted HIV cases is estimated to have increased because most paid donors belong to high risk groups, capacity for blood screening is low, and blood and its components are not rationally used in the health care system.²⁴ It is estimated that during 2003–2006, HIV prevalence was 104–112 per 100,000 donors tested in Uzbekistan: more than 100 times European Union rates.

Figure 3. HIV prevalence among blood donors in different regions of Kazakhstan, per 10,000 population, 2002–2006



Source: Data collected by CDC/CAR from National AIDS Centers.

3. Refined estimates from second-generation HIV surveillance (SGHS)

Routine epidemiological surveillance of HIV is typically based on data obtained in screening general population segments (e.g., pregnant women, army conscripts).²⁵ SGHS²⁶ of HIV began in 1998 in four Central Asian countries.²⁷ After recognizing the limitations of data obtained through routine surveillance, WHO recommended this method.²⁸

²⁴ Country Coordinating Mechanism, Republic of Uzbekistan, Proposal Form—Round 7: The Global Fund to Fight AIDS, TB, and Malaria (2007), available at: http://www.theglobalfund.org/en/files/apply/call7/notapproved/7UZBH_1601_0_full.pdf accessed March 1, 2007.

²⁵ The Determination of the HIV/AIDS Epidemics in Eastern Europe, Report on the 12th World AIDS Conference: June 28–July 3, 1998 (Geneva: Switzerland, 1998).

²⁶ SGHS systems focus on improving and expanding existing surveillance methods and combine them to raise their explanatory power. The main elements of this approach include: treating biological surveillance – clinical evidence of HIV, AIDS, STIs – and behavioral surveillance as integral components; targeting surveillance on population segments where most new infections occur, which might differ depending on the stage and type of the epidemic; and providing the rationale for the optimal use of data generated for monitoring the HIV epidemic and evaluating national AIDS control programs. (T. Rehle et al., “Second-generation HIV Surveillance: Better Data for Decision-Making,” *Bulletin of the World Health Organization* 82 (2004): 121–127.)

²⁷ B. Zhussupov, Second Generation HIV Surveillance in Central Asia: Results and Remaining Challenges, Presentation at the Second MAP Meeting in the Commonwealth of Independent States, June 25–27, 2007, Moscow, the Russian Federation.

²⁸ WHO and UNAIDS, Second Generation Surveillance for HIV: The Next Decade (Geneva: WHO and UNAIDS, 2000).

There are major limitations of data obtained from surveillance screening for HIV infection in concentrated HIV epidemics. Data quality strongly depends on: the tested groups (general population and risk groups, the latter often inadequately tested); the availability and accessibility of testing services (e.g., availability of test kits, test fees); the country's screening policies (mandatory versus voluntary); economic and fiscal conditions; and the government's political orientation and preferences.

Since the main driver of the HIV epidemic in Central Asia is IDU, knowing the prevalence of IDU and of HIV among IDUs enables a better estimate of HIV prevalence in the general population. Table 1 compares HIV data based on routine surveillance, HIV prevalence among IDUs based on SGHS, and estimated HIV prevalence for the general population in four Central Asian countries. The data suggest that HIV prevalence may be much higher than indicated by traditional surveillance methods.

Table 1. Comparison of traditional epidemiological surveillance and SGHS estimates, four Central Asian countries, per 100,000 population, 2005

	Routine HIV surveillance (general population)		SGHS: Sentinel epidemiological surveillance (IDUs)	
	Cumulative number of HIV cases	HIV prevalence/100 000	HIV prevalence among IDUs	Estimated number of cases among the general population (prevalence/100 000)
Kazakhstan	5657	37.7	5.3% (58/1082)	~15,000 (100/100,000)
Kyrgyzstan	826	16.5	8.0% (40/500)	~4000 (67/100,000)
Tajikistan	506	7.6	15.8% (95/605)	~4500 (82/100,000)
Uzbekistan	7810	31.2	26.2%(512/1956)	~117,000 (460/100 000)

Source: CDC/CAR, 2007.

4. Nosocomial transmission of HIV in Central Asia

An HIV outbreak was reported in 2006 among children in health facilities in Shymkent, a region in southern Kazakhstan. As of December 1, 2007, this region had 143 registered HIV cases among children aged one month to three years and who had been hospitalized. The Kazak Ministry of Health (MOH) and CDC/CAR implemented two hospital- and population-based case-control studies to analyze the phenomenon. Although the hospitalized children received different treatments, which may influence study findings, transfusion of blood and its components was identified as a significant risk factor for HIV transmission (OR²⁹=47.3), as was the administration of intravenous infusions with unclean syringes (OR=8.8), hospital stay exceeding 25 days (OR=6.1), and subclavian vein catheterization (OR=3.7).

This situation was replicated in late 2007 in the Osh oblast of the Kyrgyz Republic, when the Ministry of Health (Prikaz 400/13.11.2007) initiated a formal investigation of a HIV outbreak in

²⁹ Odds ratio (OR) is a measure of effect size particularly important in Bayesian statistics and logistic regression. It is defined as the ratio of the odds of an event or a disease occurring in one group that is exposed to the event or the disease, to the odds of it occurring in another group that is unexposed, and is computed by dividing the probability of the odds of disease in the exposed group by the odds of disease in the unexposed group. An odds ratio greater than 1 indicates that the odds of the condition or event is more likely in the first group, and an odds ratio less than 1 indicates that the odds of the condition or event is less likely in the first group.

collaboration with CDC/ CAR and USAID. The screening of children exposed to infectious risk during 2006-2007 in the oblast hospitals (screened 50.5 percent of total 10,400 exposed children), and detected 86 HIV positive cases with the highest infection rate between 12 to 23 months of age (predominantly in Nookat rayon). The number of hospitalizations (range 1-13, median 4.2) and invasive procedures performed (including intravenous injections, catheterization, and blood transfusions) were associated with HIV infection among children.

C. Prevention and control of communicable diseases: key for achieving the Health Millennium Development Goals (MDGs) in Central Asia

The failure to address communicable disease spread in Central Asia has in part contributed to the region's sluggish progress in achieving the health MDGs.³⁰ Some countries have seen deterioration in infant, under-five, and maternal mortality indicators, while others have experienced modest yet insufficient improvements over the last decade. The same worrisome trends have been observed for the MDGs for HIV/AIDS, TB, and other diseases (see Annex 1).

It is well documented that the spread of communicable diseases puts additional pressures on any health care system, but especially those that are fragile and underfunded. The pressures arise from increased hospitalizations, specialized medical consultations, more requests for laboratory tests, and more – often costly – medications. On the patient side, indirect costs include transportation to access diagnosis, treatment, and follow-up care; work missed by both the ill person and caretakers; and, of particular importance in Central Asia, increased out-of-pocket expenses associated with health care. This situation perpetuates a vicious cycle of poverty, preventable diseases, and premature death that investments in public health activities and strengthening health care systems could improve.

It will be difficult for Central Asian countries to meet the MDGs by 2015 unless an effective strategy to prevent and control communicable diseases, including the spread of HIV through contaminated blood transfusions, is adopted soon. Blood safety contributes to the achievement of MDGs 4, 5, 6, and 8.³¹ As the HIV epidemic in this region is predominantly among IDU, there is the potential for very rapid increases in incidence. The opportunity to improve blood safety has particular urgency because of this potential.

³⁰ World Bank, "Millennium Development Goals for Health in Europe and Central Asia," *Working Paper No. 33* (Washington, DC: World Bank, 2004).

³¹ The UN millennium development goals (MDGs) are eight goals to be achieved by 2015 that respond to the world's main development challenges, drawn from the actions and targets contained in the Millennium Declaration that was adopted by 189 nations and signed by 147 heads of state and governments during the UN Millennium Summit in September 2000. Blood safety contributes to MDGs: 4-reduce child mortality; 5-improve maternal health; 6-combat HIV/AIDS, malaria and other diseases; and 8-global partnership for development.

CHAPTER II: WHY ARE BLOOD TRANSFUSION SERVICES IMPORTANT IN A HEALTH SYSTEM?

Blood transfusions, coupled with safe medical procedures, save lives every day. Life-saving transfusions of blood or blood-based products are an indicated procedure for situations involving massive blood loss due to trauma, surgery, or hemorrhage as a complication of pregnancy. They are also used to treat other conditions, including severe anemia, hemophilia,³² and sickle-cell disease.³³

Blood transfusion services are responsible for ensuring safe and sufficient quantities of blood in a health system to protect the lives and health of a population. Blood service organizations educate, recruit and select donors, collect and process their blood, prepare blood products,³⁴ screen blood donations for various infectious markers and do other tests in a quality-controlled fashion, and in coordination with health service providers, follow up on the safe and appropriate use of blood and blood products (whole blood can be separated into blood products, both plasma and cellular components, such as red cells, white cells and/or platelets). Whole blood and its products must be stored and maintained under proper refrigeration, requiring an accurate and reliable cold chain.³⁵

A. Clinical use of blood and its products

Most transfusions in developing countries are administered for hemorrhage as a complication of pregnancy, to children with severe anemia, and serious trauma.³⁶ Reports by Ministries of Health to WHO covering 2000–2001 documented that more than 500,000 women die globally each year during pregnancy or child delivery. Central Asian countries have 10 times the maternal death ratio (i.e., the number of women who die during pregnancy or childbirth out of 100,000 pregnancies) of European Union countries: Kazakhstan's maternal mortality ratio was recently estimated at 210; while the Kyrgyz Republic's rate was 110, Tajikistan's was 100, and Uzbekistan's was 24.

About 25 percent of deaths worldwide during pregnancy or delivery result from massive obstetric bleeding requiring blood transfusion. Modern obstetrics can save women by recognizing and managing obstetrical hemorrhage, and a key element of such management is blood transfusion. Similarly, severe anemia may require transfusion. Anemia during pregnancy

³² An inherited bleeding disorder in which blood does not clot normally. It may lead a person to bleed for a longer time than others after an injury, and to internal bleeding, damaging organs or tissues, and sometimes can be fatal.

³³ Sickle cell disease is an inherited blood disorder that affects red blood cells. People with sickle cell disease have red blood cells that contain mostly hemoglobin* S, an abnormal type of hemoglobin. Sometimes these red blood cells become sickle-shaped (crescent shaped) and have difficulty passing through small blood vessels.

³⁴ The WHO definition for blood products includes blood components (labile) and stable blood fractions resulting from plasma processing. The European Union blood directive has different definitions, considering that only the stable fractions are blood products.

³⁵ Different blood products require different storage temperatures (variations between +21° C to -40° C according to type of product).

³⁶ UNAIDS, "Blood Safety and HIV," *UNAIDS Technical Update* (Geneva: UNAIDS, 1997).

is also associated with increased stillbirths, perinatal deaths, low-birth-weight babies and prematurity. In malaria-endemic countries, anemia is one of the most common preventable causes of death in pregnant women and also in children under five years of age. Victims of violence and injuries involving major trauma and burns with important blood loss also need blood transfusions. This is a growing problem worldwide, that accounts for 9 percent of global mortality or 5 million deaths; road crashes kill 1.2 million people each year and injure as many as 50 million.³⁷ Blood also is needed for people requiring complicated surgical procedures that result from noncommunicable diseases such as cardiovascular diseases and cancer

B. Availability of blood supplies

Information from the WHO global database indicates that in 2004, blood services in 172 countries collected a total of 81 million units of blood. However, only 1 percent was collected in low income countries, where about 37 percent of the world population lives, 44 percent was collected in medium income countries, and 55 percent in high income countries. In addition, 94 percent of blood collected in high-income countries is donated without pay, whereas 43 percent of blood in low- and middle-income countries is for pay or from replacement donors.³⁸ The pool of voluntary, low-risk blood donors is constantly shrinking as communicable disease prevalence expands in resource-limited settings.

The problem of blood supply shortages, as well as increasing safety concerns, is particularly acute where paid and family replacement donors—often a form of hidden paid donation—are the main source of the blood supply. Despite improvements, efforts to recruit voluntary, unpaid donors remain insufficient. Only 26 of the 53 WHO European Member States, that include the Central Asian countries, have national programs for voluntary blood donation. Another 17 are developing such programs, and 4 report that they have only a few regular voluntary donors. Although progress has been made, too many countries in Central Asia depend on paid and replacement donations.

C. Testing for blood borne infections³⁹

Standard blood safety principles provide that blood services screen blood and blood products for at least HIV, hepatitis B and C, and syphilis contamination.⁴⁰ Complete and accurate data on testing of donated blood is not available in most developing countries, particularly where blood services lack reliable testing systems, experienced staff, quality test-kits, regularly supplied

³⁷ WHO/World Bank. World Report on Road Traffic Injury Prevention. Geneva, WHO, 2004.

³⁸ Where health facilities have blood supply shortages, patients needing transfusions recruit friends and family members for donations before the patient undergoes a procedure requiring a transfusion. These "family replacement" donations are seen as essential but are not very safe. Like paid blood donors, replacement donors offer less safe blood than those who donate for the public good (P Carolan and M García, Gift Blood Is the Safest Blood, *Perspectives in Health* 10(2) (2005). Accessed at www.paho.org on March 9, 2008.

³⁹ Donated blood is subject to various tests, including standard laboratory screening tests (e.g., to determine hemoglobin levels), tests for infectious markers, and immuno-hematology tests or compatibility tests. Given the purpose of this report, emphasis is placed on the infectious component only.

⁴⁰ *The Lancet*, "Improving Blood Safety Worldwide," editorial 370(4) (2007): 361.

materials, and basic laboratory quality assurance systems.⁴¹ The WHO Global Database on Blood Safety revealed that not all blood donations are tested for transfusion transmitted infections, and national coordination of blood services is missing in 66 countries.⁴²

Donated blood is discarded if it tests positive for contaminants. The European Centre for the Epidemiological Monitoring of AIDS (EuroHIV) has estimated that discarded donations average 1.3 units per 100,000 units in western countries, 2–10 per 100,000 in Central European countries, and 30–90 per 100,000 in the FSU countries. The problem is particularly acute where paid or replacement donors are the main source of the blood supply.

In FSU countries, some blood services are functioning well and providing safe transfusions. However, and particularly in Central Asia, existing blood services are in dire need of reorganization and upgrading, with particular emphasis on strengthening the control systems that would ensure the quality and safety of transfusion therapy.

D. HIV infection through blood transfusions

A 2006 report estimated that of the 33–36 million people estimated to be HIV positive worldwide, 5–10 percent were infected by a contaminated blood transfusion.⁴³ Direct blood stream exposure to HIV is the most efficient means of transmission, and the nature of exposure through transfusion further heightens transmission efficiency. More than 92 percent of HIV-contaminated transfusions result in infection, while less than 1 percent of intravenous drug injections with a contaminated syringe do.⁴⁴ Box 2 documents the spread of HIV due to the use of contaminated blood in different countries.

Over the last 30 years, major technological developments have significantly improved ability to protect the blood supply from dangerous pathogens,⁴⁵ but deficiencies in the way blood is collected, tested or not tested for infections, and transfused put people at risk of becoming infected with HIV and other infections, such as hepatitis B and C, syphilis, and malaria. The 53 countries that comprise the WHO European region (which include Central Asian republics) face considerable risk of transmission of HIV through blood transfusion, and the prevalence of HIV in donated blood units varies dramatically from east to west in this region. Lack of appropriate regulatory frameworks, technology, and means to recruit voluntary and unpaid donors contribute to this problem.⁴⁶

⁴¹ WHO, “Blood Safety and Donation,” WHO Fact Sheet, # 279 (June 2007), available at <http://www.who.int/mediacentre/factsheets/fs279/en/>.

⁴² WHO, Proposal for Establishment of World Blood Donor Day (Geneva: WHO, 1997).

⁴³ R. Baggaley, et al. “Risk of HIV-1 Transmission for Parenteral Exposure and Blood Transfusion: A Systematic Review and Meta-analysis,” editorial review, AIDS. 20(6) 2006: 805–812.

⁴⁴ WHO. Blood Transfusion Safety (Geneva: WHO Department of Essential Health Technologies, not dated), available at www.who.int/eht.

⁴⁵ S. D. Roseff. “Regulatory Requirements for Testing the Donor Blood Supply,” Clinical Microbiology Newsletter 27(11) 2005: 83–90.

⁴⁶ WHO-EURO. First Regional Meeting of Directors of Blood Transfusion Services in Europe. Copenhagen, Denmark, 4-5 June 2007.

Box 2: Country Experiences with contaminated blood and the spread of HIV

China

In late 1994, a considerable number of cases of HIV infection were identified among commercial plasma donors in Yunnan province of China. In August 2001, the government published estimates suggesting that about 6 percent of 600,000-800,000 people living with HIV (PLHIV) were infected through contaminated blood. In 2003, the government estimated that 9.4 percent of PLHIV were infected through blood transfusion, and 1.6 percent through blood and blood product use. The government response was to prohibit importing of blood and blood products from abroad. However, this increased business opportunities of domestic commercial blood collecting companies whose clients were mostly poor rural farmers paid US\$5 per collection. The for-profit companies have mostly operated illegally and sold the products domestically and internationally.⁴⁷ By September 2003, cases of HIV related to plasma or blood donation were reported in all provinces, autonomous regions and municipalities in China. The actual number of people infected through contaminated blood is unknown, but experts estimate the number at over one million in Henan province alone.⁴⁸ The 2001-2005 national plan to prevent and control the spread of HIV/AIDS mandated that blood for clinical use would have to undergo complete HIV testing.

France

A major public health scandal occurred in the 1990s when 1,250 people, mostly hemophiliacs, were infected with HIV, through tainted blood transfusions that took place in 1984 and 1985. High government officials, including a former Prime Minister and two former Cabinet ministers, were put on trial on charges of allowing HIV-contaminated blood and blood products to be used in transfusions.⁴⁹

Romania

The 1989-1990 pediatric HIV epidemic in Romania infected 762 children who were born to uninfected mothers in Constanta. The infection was presumed to be related to the use of unsterilized needles and syringes, or transfusion of unscreened blood or blood products (blood donation testing for HIV was introduced in late 1990).⁵⁰ Also, more than 7,200 Romanian teenagers between the age of 15 and 19 were infected with HIV between 1986 and 1991 in hospitals and orphanages across the country after they underwent minor blood transfusions in the mistaken belief that it would boost their immunity.⁵¹

⁴⁷ HIV and AIDS in China, from: www.avert.org/aidschian.html , also see Gill, B., J. Chang, S. Palmer, "China's HIV Crisis." *Foreign Affairs*, 81(2002):96-110.

⁴⁸ HIV and AIDS in China, from: www.avert.org/aidschina.htm

⁴⁹ The Dallas Morning News. "France to try ex-officials in AIDS deaths. Three accused in scandal over contaminated blood". July 18, 1998.

⁵⁰ Kozinetz, C. The burden of pediatric HIV/AIDS in Constant, Romania. Baylor College of Medicine, 2001.

⁵¹ The Statesman (India). *Teenagers infected with HIV by Romania left to fate*. August 2, 2006.

E. Recommended strategy for strengthening blood transfusion services

WHO⁵² recommends that countries establish the following building blocks to develop well-organized and sustainable blood transfusion services:

- national coordination of blood services;
- blood collection from voluntary, unpaid donors from low-risk populations;
- appropriate testing, processing, storage, and distribution of blood and blood components;
- reduction of unnecessary transfusions through the effective clinical use of blood, including availability of alternatives to transfusion; and
- quality systems covering every step of the blood chain, from media campaigns to recruit altruistically driven donors to the monitoring of health outcomes of patients who receive transfusions.

F. The challenge in Central Asia

Central Asian countries require immediate action to secure their blood supplies from the threats posed by a rapid and increasing IDU-driven rise in HIV (which SGHS data suggest are higher than reported); and high rates of hepatitis B and C, syphilis, and malaria. These threats are made more complicated and more urgent by increasing movement of people across national borders and increasing IDU, as well as differences among countries in quality standards and safety requirements applied to health services. This report addresses one threat—deficiencies in blood transfusion services—but it is a key, addressable factor in the chain linking communicable disease spread to the general population.

To protect people in Central Asia from contaminated blood transfusions and related unsafe medical practices, a well-organized blood transfusion service, with quality control systems in all areas, must be established. Providing accurate and comprehensive data about transfusion services in Central Asia is an essential first step towards a quality, safe and adequate blood supply.

⁵²WHO. 2002. Aide-Memoire for National Blood Programmes. Geneva: WHO.

CHAPTER III: STATE OF BLOOD TRANSFUSION SERVICES AND SAFETY OF THE BLOOD SUPPLY IN CENTRAL ASIA

In 2007, the United States Centers for Disease Control and Prevention/Central Asia Regional Office (CDC/CAR), under a co-financing arrangement with the World Bank, assessed the status of blood transfusion services and the safety of the blood supply in the health systems of four countries in Central Asia: Kazakhstan, Kyrgyz Republic, Tajikistan, and Uzbekistan. (Turkmenistan was not included because the assessment began during the recent political transition in that country.) In preparing this report, the World Bank team relied on the evidence from the CDC/CAR 2007 assessment, the results of related assessments conducted since 2004, and reviewed other relevant published and unpublished sources.

The main objective of the assessment was to learn about the factors contributing to unsafe blood supplies in the health systems of the Central Asian countries. *This assessment is an initial attempt to document the systemic problems affecting blood transfusion services in this region.*

The assessment specifically aimed to determine:

- the status of blood transfusion services in the four countries;
- the sensitivity of donor blood screening for communicable diseases (HIV, hepatitis B and C, and syphilis) in the blood service laboratories surveyed in three of the countries; and
- the prevalence of markers of parenteral or injection-transmitted infections among donors.

A. Methodology

Box 3 summarizes the methodology followed by the CDC/CAR team in assessing the status of blood services and the safety of the blood supply in the health systems of the four countries. A detailed description of the methodology is provided in Annex 2.

B. Main Findings of the Overall Assessment

This section provides a summary of the problems common to all blood transfusion services in the Central Asia region's health systems that were identified by the CDC/CAR assessment, complemented by the review carried out by the World Bank team. The summary presents *aggregated* data from the surveyed countries. Given the sensitivity of the topic, specific data pertaining to each individual country are not presented. This is also at the request of the Central Asian governments, and was the agreed condition for the country health authorities to participate in the assessment. Individual country results were submitted by CDC/CAR to the respective Ministries of Health and discussed at special meetings of the Boards of the Ministries of Health in each country. As a result of these discussions of the findings of the assessment, as with similar assessments in previous years, measures were developed in each of the countries in 2007 and some activities initiated to improve the safety of the blood transfusion services.

The summary is organized under four thematic areas that are considered by WHO to be critical parts of an effective strategy for ensuring blood safety: (i) a well organized and operated blood transfusion service; (ii) collection of blood from low-risk populations; (iii) appropriate testing of all donated blood, including screening for transfusion-transmissible infections, blood grouping

and compatibility testing; and (iv) reduction in unnecessary transfusions through the effective clinical use of blood, including the use of simple alternatives to transfusion, wherever possible.

The results of this assessment can help governments to develop measures to prevent the transmission of communicable diseases, particularly HIV/AIDS, hepatitis B and C, and syphilis through contaminated blood and blood products in their health care systems.

Box 3: Methods Used in Assessing the Status of Blood Services and Safety of the Blood Supply in Central Asia

Summary: During 2007, in two surveyed countries, 2500 venous blood samples (10 ml.) were collected in each country from among donors who donated their blood only once during the survey period. In a third surveyed country, 2500 donor blood sera samples were collected, of which 2129 were blood bags (sealed system) and the remaining 371 cases were collected with multiple use vials. Samples included all donors, regardless of the type (blood donors or/plasma donors) and kind (unpaid, paid, donors-relatives), who donated blood only once during the given period. Epidemiological data on donors were collected using a specially developed questionnaire. The questionnaire included demographic information and possible donor infection risk factors (Annex 3). Each serum sample collected was divided into two aliquots: one processed through routine screening in the respective blood center's laboratory, and the other placed into disposable tubes, kept strictly at -70°C , and delivered to the national reference laboratories (ensuring accuracy of the cold chain).

Sites Visited:

Kazakhstan: Republican Blood Center, Republican AIDS Center, Institute of Pediatrics, Kaskelen Oblast Blood Center, Karaganda Oblast Blood Center, Karaganda Oblast Hospital, Karaganda AIDS Center, Temirtau City Blood Center, Reference Laboratory for Viral Hepatitis in Almaty, and the Central City Hospital Blood Center in Almaty.

Kyrgyz Republic: Republican AIDS Center, Republican Blood Center, Republican National Hospital Cardiothoracic Surgery Department, Blood Transfusion Department, Sukoluk Rayon Hospital, Blood Transfusion Department in Kara-Balta Hospital, and Republican Reference Laboratory for Viral Infections.

Tajikistan: Republican Blood Center, Kurgan-Tyube Oblast Blood Center.

Uzbekistan: Institute of Hematology and Blood Transfusion (including Republican Blood Center), Republican Reference Laboratory for viral hepatitis, Tashkent Municipal Blood Center, Institute of Thoracic Surgery, and Samarkand Oblast Blood Center.

Protection of Human Subjects

Justification for Waiver of Informed Consent:

CDC/CAR requested a waiver of informed consent based on two criteria: (1) the research involved no more than minimal risk to the participants; and (2) the research could not have been carried out without the waiver. By virtue of inclusion criteria, participants already had consented to donate blood and this study required nothing from participants above and beyond their standard blood donation procedure. In addition, the waiver was required due to the fact that the research was conducted on samples that were collected in Blood Centers in 2007. In order to obtain informed consent, the donors would have had to be identified and located which could have resulted in a breach of confidentiality and would have been cost-prohibitive.

1. Status of blood transfusion services in Central Asia

a. Shortcomings in the organization and financing of blood transfusion services

The status, organization and delivery capacity of the blood service are closely linked and reflect the development of the national health system. The overall organizational structure of the health care systems in the four Central Asian countries assessed is not adequate to meet the needs of their populations, and the systems are underfunded.⁵³ Total spending on health in the countries varies: 3.3 percent of GDP in Tajikistan, 3.5 percent in Kazakhstan, 4.3 percent in the Kyrgyz Republic, and 5.5 percent in Uzbekistan. Public sector expenditures on health, measured as a share of total expenditure on health, are 28 percent in Tajikistan, 46 percent in Uzbekistan, 51 percent in the Kyrgyz Republic, and 53 percent in Kazakhstan. These figures are among the lowest in the FSU countries.

The organization of public health services in Central Asia has not changed significantly since the dissolution of the Soviet Union and remains located in a specialized vertical structure of the health system (State Committee on Sanitary and Epidemiological Inspection, SANEPID). Blood services are very fragmented and mostly hospital based, with no national coordination. Ministries of Health regulate all blood service activities, but most of the countries lack adequate laws, regulations, policies, and strategies on blood services. Blood centers provide medical facilities with blood and blood products. Regional blood centers and departments of blood transfusion operate under the authority of the head of oblast hospitals and are expected to provide technical support to blood centers at lower levels in the health system.

There is no national center for coordinating blood transfusion services in any of the countries. The republican blood centers only nominally control/supervise oblast and rayon blood centers. For example, in Uzbekistan's blood transfusion system, which has 23 stations and 238 (mostly hospital-based) blood transfusion department units, most health facilities manage donor blood banking on their own.

Blood services in Central Asia are financed under two modalities: the Republican Blood Centers receive their budgets directly from the Ministries of Health, and oblast blood centers, rayon and other lower-level blood facilities are funded from local budgets. Public funding for blood transfusion services has decreased significantly in all Central Asian countries since the mid-1990s. Budgetary allocations for these services range from 0.5 to 0.98 percent of the total public health budget. Lack of adequate funding for these services is reflected in deteriorated infrastructures, obsolete equipment, and lack of basic supplies such as test-kits, reagents, and disposables (e.g., syringes, blood bags, gloves and tubes). Limited funding means also that blood centers cannot regularly purchase test-kits that meet international standards, reducing blood screening accuracy. Lack of funding and poor working conditions have contributed to dire shortages of qualified personnel, including laboratory specialists. In some Central Asian countries, the number of qualified staff working in these services has declined significantly, reflecting a general trend at the health system level. Remaining blood services personnel generally lack the knowledge and skills necessary to recruit donors, to perform accurately the operations required for blood collection, processing and storage, to advise on the rational use of blood and blood products, and to manage and ensure the overall quality of services. Throughout Central Asia, a few blood service specialists have adequate training and follow international, evidence-based procedures.

⁵³ WHO EURO, Health Care in Central Asia, 2002.

Since 2004, blood transfusion management committees have been established in some public hospitals in Central Asian countries, but their competence has yet to be studied.

b. Lack of safe donors, unsafe blood donations, and limited blood stocks

None of the surveyed countries has a national blood donor program in place, effective blood donor recruitment protocols or national donor recruitment education schemes to attract unpaid donors from low-risk groups, nor do they have mobile teams to collect blood. Kazakhstan sometimes organizes donor campaigns, but they are neither held regularly nor widespread.

Blood donation shortages in some countries result from stigma, fear of contracting HIV, and a culture that does not encourage donating blood (that is, society attaches no value to voluntary blood donation). WHO estimates that less than 1 percent of the total population in Central Asia donates blood, with a dramatic drop of donors in the last 3 to 5 years, whereas international standards suggest that 2.5 percent of a country's population should donate blood to provide for potential needs. As a result, blood services in Central Asia lack adequate and safe blood supplies, putting at risk patients requiring transfusions.

Reliance on paid blood donors is common in Central Asia and other developing regions. In Central Asia, it is estimated that blood services rely on paid donation in up to 80 percent of cases to secure their needs. Donors typically have low incomes and include high-risk groups, such as IDUs and people who are under- or unemployed and who may be in poor health, undernourished, and at risk of having blood transfusion-transmissible infections. A paid blood donor in the Kyrgyz Republic, for example, receives about US \$5 per donation;⁵⁴ this price is set by a Government committee that is responsible for elaborating price schedules for all public organizations.

Replacement donors are also common in Central Asia, and usually are paid for replacement donations. In Uzbekistan, as well as in other countries, prior to surgery, the relatives of patients are required to donate blood. This attracts so-called "black donors": often people from high risk groups with increased exposure to HIV, hepatitis B and C, and syphilis infection, posing as relatives and donating for informal pay. This group of donors is also at considerable risk for anemia, as they are likely to donate more often than recommended. This practice threatens the safety of the blood supply particularly as the criteria for selecting or deferring donors may not be appropriately applied.

WHO and UNAIDS recommend unpaid regular donors, as the foundation for a safe blood supply. Since they donate from altruism rather than financial or institutional pressure, they are more likely to meet the medical selection criteria for safe donors, to disclose any known possibility of risk exposure, and are more willing to donate blood regularly and at properly spaced intervals.

In some Central Asian countries the prevalence of parenteral infections among donors almost equals the prevalence amongst the general population, which reflects an inadequately developed system of donor recruitment and selection and laboratory screening. For example, the prevalence of hepatitis C among blood donors is estimated at 3 percent, which is about equal to that among the general population.

⁵⁴ Government of the Kyrgyz Republic, Application to The Global Fund to Fight AIDS, Tuberculosis and Malaria (Bishkek: July 2007).

The increased discard rate of donated blood due to contamination not only exacerbates the cost of blood services but also has a negative effect on blood supply availability. In the Kyrgyz Republic in 2006, of the total donated blood tested, more than 13 percent was discarded due to the detection of infectious agents.⁵⁵

Little information exchange occurs among blood centers, public health agencies, and medical facilities on donors' epidemiological data, including demographic data, infection risk factors, and parenteral infections, rendering the donor recruitment information system out-of-date. Nor is there coordinated cooperation between blood service specialists and physicians who order the administration of blood and its products to patients. Deficiencies in the transfusion services are compounded by a lack of systematic follow-up of donors and recipients and the absence of national donor registries in Central Asia.

c. Deficiencies in donor blood screening

Screening (testing) of donated blood detects transfusion-transmissible agents of communicable diseases, although there is the risk that cases of transfusion-associated HIV transmission can be caused by blood donated during the infectious window period (i.e., when recently infected donors are infectious but have not yet developed detectable levels of HIV antibody), as well as related test limitations. Good laboratory practices are also required to ensure correct blood grouping, compatibility of donor and recipient, and the provision of safe and effective blood and blood products.

In many developing countries, blood is screened only in large urban areas, often due to lack of funding. Central Asia is no exception -- the general quality assurance system and internal quality controls related to blood screening in blood center laboratories do not function adequately.

Tajikistan illustrates well the prevalent situation: a reported 3 percent of the blood transfused in 2005 (750 units) were not tested for HIV or hepatitis B or C antibodies. More than 2 percent of the officially reported HIV cases were due to contaminated transfusions.⁵⁶ While a 2004 CDC/CAR study found a high prevalence of transfusion-transmissible infections among donor populations (HIV: 0.2 percent; hepatitis B: 3 percent; hepatitis C: 4 percent), the blood center laboratories were unable to detect the same prevalence of these infections in donated blood.

Some facilities in Central Asia never test donations. Some rayon (local level) facilities lack laboratory equipment, test-kits, or staff trained to screen donations, therefore blood samples are sent to oblast or regional blood centers for screening, with the associated delays in obtaining results. As a consequence, blood transfusions at some rayon facilities are administered without screening or before test results are received. Overall, an estimated 35–50 percent of transfusions given in remote, rayon-level blood centers in three Central Asian countries are not tested, due to frequent interruptions in the supply of test-kits or due to the lack of dedicated laboratories.

In some Central Asian countries, blood center laboratories use locally-produced test-kits whose quality does not meet internationally accepted requirements on test specificity and sensitivity. Some laboratories accept test results without proper assessment of the test accuracy or validity.

⁵⁵ Government of the Kyrgyz Republic, Application to The Global Fund to Fight AIDS, Tuberculosis and Malaria (Bishkek: July 2007).

⁵⁶ Republic of Tajikistan, Application to the Global Fund to Fight AIDS, Tuberculosis and Malaria: Round 6 (Dushanbe: 2006).

Follow-up confirmation of donors' laboratory diagnosis, where samples are sent to a republican or oblast AIDS center laboratory for re-screening, is done only for HIV-positive cases. Donor samples that are positive for hepatitis B or C are not subject for re-screening. Internal laboratory quality control of blood screening for parenteral infections is rarely done in Central Asia.

No mechanisms are in place to provide counseling to seropositive donors and their families concerning status and parenteral infections. In some rayon blood centers, test results are recorded on the donor card, violating confidentiality. No follow-up assessment is done with donors whose positive test results cause them to be banned from donating, although there appears to be no adequate system to ban infected people from donating. This is especially alarming since due to the quality of tests and testing procedures there is no certainty that blood samples will test positive if the infected person tries to donate again.

In some centers, locally produced polyclonal anti-sera are used to perform blood grouping, although international recommendations call for standardized production processes and reagents. These practices generate additional risks due to increased possibility of fatal non infectious cross-reactions (ABO incompatibility between donor and patient blood; a reaction of the immune system that occurs if two different and not compatible blood types are mixed together).

d. Poor blood banking conditions and practices

If the collection and storage of blood is not properly done, blood transfusions can result in lethal overwhelming bacterial sepsis and transmission of blood borne pathogens such as HIV, hepatitis B and C, syphilis, and malaria.^{57, 58, 59, 60}

Poor operating conditions and practices are prevalent in the Central Asian blood centers. Overall, there is no centralized authority responsible for blood quality and safety in national level blood centers. National quality standards have not been developed, and the present system of quality control of blood banks is deficient. Outdated equipment is used to produce plasma fractions, which requires particular attention (this situation is especially serious in one of the republics).

Throughout the four countries, multiple-use glass bottles are mostly used to collect and process blood. In one country, glass bottles are used repeatedly for blood collection and for packaging plasma fractions, increasing the risk of parenteral infection transmission. Additionally, some centers lack disposable gloves and devices (i.e., finger pricks), endangering the safety of donors, patients and health workers alike. In some centers, for instance, health workers handling blood and blood products (e.g., collecting, screening, and disposing of blood products) receive only one pair of gloves a day. In many of the virology laboratories of blood centers, dispenser caps for enzymeimmunoassay (EIA) tests are reused for 12 months, although the international norm recommends limiting their use to five times.

⁵⁷ S Luby et al., "Evaluation of Blood Bank Practices in Karachi, Pakistan, and the Government's Response," *Health Policy and Planning* 15(2) (2000): 217–22.

⁵⁸ A. E. Greenberg et al., "The Association between Malaria, Blood Transfusions, and HIV Seropositivity in a Pediatric Population in Kinshasa, Zaire," *Journal of the American Medical Association* 259(4) (1988): 545–49.

⁵⁹ G. A. Schmunis et al., "Risk for Transfusion-Transmitted Infectious Diseases in Central and South America," *Emerging Infectious Diseases* 4(1) (1998), accessed at <http://www.cdc.gov/ncidod/eid/vol4no1/schmunis.htm> on March 2, 2008.

⁶⁰ J. R. Cruz et al., "Safety of Blood Supply in the Caribbean Countries: Role of Screening Blood Donors for Markers of Hepatitis B and C Virus," *Journal of Clinical Virology* 34(2) (2005): S95-S80.

e. Inappropriate clinical use of blood in health facilities

A previous section reported strikingly low rates of blood supplies in Central Asia: 5-6 donations per 1,000 population per year, well below the WHO recommended 20–25 donations per 1,000 population per year, with discard rates as high as 13 percent of total blood collected.

Resulting shortages are exacerbated by unnecessary or inappropriate transfusions. Central Asian countries have outdated guidelines for the clinical use of blood to guide physicians in its administration. In some countries the guidelines are local rather than national. There is a need therefore to develop national modern guidelines for the optimal use of blood, that are evidence based, and that encourage the use of alternatives whenever possible. Based on historical practices, physicians often use whole blood for transfusion therapy regardless of the patient's need. Furthermore, children's hospitals, lacking pediatric units, regularly distribute a single, adult-sized unit among multiple recipients. A widespread belief that blood and blood products transfusions are the best treatment for a variety of illnesses contributes to the popularity of transfusions among health care workers and patients. Worse yet, physicians often have a financial interest in recommending transfusions and advocate their use even when not medically necessary, and most health facilities lack a dedicated blood transfusion committee. Attending physicians rarely monitor or evaluate the patient's post-transfusion outcome.

Due in part to a shortage of simple volume replacement solutions (such as saline and colloid solutions) as well as skepticism among health personnel toward their use, blood and blood products treatment for various conditions is prevalent in Central Asia. Plasma is often prescribed after a surgery to prevent infection when antibiotics should be prescribed.

The evaluation of the HIV outbreak in Shymkent, Kazakhstan in 2006 demonstrates that quality controls to ensure compliance with safety standards for blood transfusion are weak or disregarded. As was documented by the country's MOH and CDC/CAR, the infections were likely caused by transfusion of HIV-infected blood, repeated use of non-sterile medical equipment, improper use of blood and its products, and lack of infection control procedures during medical interventions.

2. How safe is the blood supply in Central Asia?

a. General considerations on basic screening of donated blood for infectious markers

A cornerstone for maintaining a safe blood supply in any country is the testing of donated blood. In the United States, for example, the Federal Drug Administration requires that all blood centers test each unit of blood for a variety of blood-borne diseases; it also reviews and approves all assay test-kits used to detect infectious disease in donated blood.⁶¹ International norms and standards suggest that each unit of blood must be tested for HIV, hepatitis B and C, and syphilis at a minimum.

HIV tests are conducted to: (i) screen donated blood, (ii) survey HIV prevalence or trends, and (iii) diagnose individual infections. These objectives require combining and sequencing tests, and local conditions such as daily volume of tests, staff training levels, and comparative costs

⁶¹ M. Revelle, "Progress in Blood Supply Safety," *FDA Consumer Magazine* (1995), accessed at http://pueblo.gsa.gov/cic_text/health/blood-ss/blood2.htm on March 2, 2008.

influence the type of test chosen.⁶² ELISA tests are appropriate for blood banks testing over 100 samples or less per day or batch testing for surveillance; rapid tests, which do not need special equipment or highly trained staff, are appropriate for other settings. Both types of test are reliable when manufactured and used correctly. Initial positive results cannot be seen as conclusive but must be confirmed by confirmatory tests.

Hepatitis blood tests detect the antibodies to viruses that cause hepatitis A, B, or C.⁶³ The panel of tests can be used to screen blood samples for more than one kind of hepatitis virus at once.

Syphilis tests detect antibodies to syphilis bacteria.⁶⁴ Detection of these antibodies helps identify donors who are at risk of STIs, including HIV. The tests used to screen for or confirm syphilis include: (i) the venereal disease research laboratory (VDRL) test, (ii) the rapid plasma reagin (RPR) test, and (iii) the EIA test; a positive EIA test should be confirmed with either the VDRL or RPR tests. The Wasserman test is also used in some countries in spite of its limited accuracy.

The ALT (alanine aminotransferase) test detects liver injury. An increased level of ALT (an enzyme produced in hepatocytes, the major cell type in the liver) in the blood is caused by liver damage due to all types of hepatitis (viral, alcoholic, drug-induced). ALT elevation also occurs in cases of liver cell death resulting from other causes, such as shock or drug toxicity.⁶⁵

Reactive or indeterminate test results require that donated blood be discarded in accordance with recommended safety instructions, as it must be considered infected.⁶⁶

b. Determining the accuracy or validity of blood tests

Two indices are used to determine the accuracy of blood tests: *sensitivity and specificity*.⁶⁷ They require administering the test to one batch of blood samples from people known to have the disease and another batch from people known not to have it. Results are compared for sensitivity and specificity. *Sensitivity* refers to the ability of assay to correctly identify samples that do contain the tested infectious marker, and *specificity* refers to the ability of the assay to identify correctly samples that do not contain the tested infectious markers. Confidence limits and predictive values must be considered as well when a test is evaluated. Evaluation of the quality of screening methods and prevalence of serologic makers for communicable diseases, therefore, provides a proxy estimate of the risk of blood-transmitted infections.^{68 69}

⁶² UNAIDS, "Blood Safety and HIV," *UNAIDS Technical Update* (Geneva: UNAIDS, 1997).

⁶³ US National Library of Medicine, "Hepatitis Virus Test or Panel," *MedlinePlus Medical Encyclopedia* accessed on March 1, 2008.

⁶⁴ WebMED, Syphilis Tests (Sexual Conditions Health Center), accessed on March 1, 2008.

⁶⁵ Worman, H.J. Common Laboratory Tests in Liver Diseases. Accessed at <http://www.cumc.columbia.edu/dept/gi/labtests.html> on March 18, 2008.

⁶⁶ WHO/UNAIDS, "Revised Recommendations for the Selection and Use of HIV Antibody Tests," *Weekly Epidemiological Record* 72(12) (1997): 81–88.

⁶⁷ A. M. Lilienfeld and D. E. Lilienfeld, *Foundations of Epidemiology* (New York: Oxford University Press, 1980).

⁶⁸ G. A. Schminis et al., "Risk of Transfusion Transmitted Infectious Diseases in Central and South America," *Emerging Infectious Diseases* 4 (1998): 5–11.

⁶⁹ If: True positive (a); False positive (b); False negative (c); True negative (d); then,
Sensitivity = a/ (a+c)

c. Assessing the accuracy of screening of donated blood in Central Asia to prevent the spread of communicable diseases due to contaminated blood transfusions

To assess the accuracy of blood screening in Central Asia, a CDC/CAR survey team tested 7,500 blood samples in national reference laboratories: 5,000 samples from two republican blood centers and 2,500 from an oblast center (Annex 2 describes the type of tests performed). These samples were screened for markers indicating HIV, hepatitis C and B, and syphilis. The results were compared to those from tests by the blood centers that had collected the blood from donors. The comparisons indicate the “sensitivity” (or accuracy) of the blood center tests. This section presents the results of the sensitivity screenings and information on donors who gave contaminated blood.

Results of HIV tests: Of 7,500 donor blood samples tested in the survey centers, the reference laboratories detected HIV antibodies in 11 (0.15 percent); only six of which had been identified as positive by the blood centers (Table 2). Test sensitivity for HIV in the blood center laboratories was thus **54.5 percent** (6/11; 95 percent CI 25.9–81.0 percent).

Table 2. Anti-HIV: Comparison of laboratory test results

Blood center laboratories	Reference laboratories		Total
	Positive	Negative	
Positive	6	13	19
Negative	5	7476	7481
Total	11	7489	7500

Results of Hepatitis B tests: The reference laboratories detected hepatitis B surface antigen (HBsAg) in 200 samples (2.7 percent), including 121 identified by the blood center laboratories (Table 3). Test sensitivity for HBsAg in the blood center laboratories was **60.5 percent** (121/200; 95 percent CI 53.6–67.1 percent).

Table 3. Hepatitis B (HBsAg): Comparison of laboratory test results

Blood center laboratories	Reference laboratories		Total
	Positive	Negative	
Positive	121	43	164
Negative	79	7257	7336
Total	200	7300	7500

Results for Hepatitis C tests: Of the same 7,500 blood samples, the reference laboratories detected antibodies to HCV in 228 (3.04 percent); only 182 had been identified in the blood center laboratories (Table 4). Test sensitivity for HCV in the blood center laboratories was **79.8 percent** (182/228; 95 percent CI 74.2–84.7 percent).

Specificity = d/ (b+d)

Positive predictive value = a/ (a+b)

Negative predictive value = d/ (c+d)

Table 4. Hepatitis C (Anti-HCV): Comparison of laboratory test results

Blood center laboratories	Reference laboratories		Total
	Positive	Negative	
Positive	182	43	225
Negative	46	7229	7275
Total	228	7272	7500

Results for syphilis tests: Syphilis diagnostics in the republican blood centers are based on the Wassermann test, while the oblast blood center screens for Antitreponemal AB/TPHA. Of 5,000 blood samples from the republican centers, the reference laboratories detected syphilis in 214 (4.3 percent); only 31 had been identified by the blood centers (Table 5). Screening sensitivity in the blood center laboratories was only **14.5 percent** (31/214; 95 percent CI 10.2–19.7 percent).

Table 5. Syphilis Tests (Wassermann): Comparison of laboratory test results

Blood center laboratories	Reference laboratories		Total
	Positive	Negative	
Positive	31	3	34
Negative	183	4783	4966
Total	214	4786	5000

Of the 2,500 tests performed on samples collected at the oblast site, the reference laboratories detected anti-syphilis markers in 53 (2 percent); only 21 had been detected by the oblast blood center laboratory (Table 6). Screening sensitivity in the blood center laboratory was **40 percent** (21/53; 95 percent CI 26.7–53.9 percent).

Table 6. Syphilis (Anti-Syphilis): Comparison of laboratory test results

Blood center laboratory	Reference laboratories		Total
	Positive	Negative	
Positive	21	2	23
Negative	32	2445	2477
Total	53	2447	2500

Although blood center laboratories used different screening methods for syphilis, the assessment determined the general diagnostic sensitivity of the two methods combined. The reference laboratories detected the syphilis marker in 267 of 7,500 samples (3.6 percent); the blood center laboratories had detected only 52 (Table 7). Screening sensitivity in the blood center laboratories with both diagnostic methods was **19.5 percent** (52/267; 95 percent CI 15–24.8 percent).

Table 7. Syphilis (Wasserman and anti-Syphilis): Comparison of laboratory test results

Blood center laboratories	Reference laboratories		Total
	Positive	Negative	
Positive	52	5	57
Negative	215	7228	7443
Total	267	7233	7500

d. Overall assessment of accuracy of the test results of blood centers laboratories in Central Asia: there is a significant risk of introducing contaminated blood into the blood supply unless preventive measures are adopted on a wide scale.

Sensitive screening tests of blood donations and mandatory quality assurance systems (control over the entire process, from the development of protocols for procedures, techniques, reagents, equipment use and maintenance, and personnel, to performance evaluation to validate the results obtained) are an essential component of maintaining the safety of blood supply in a country.

Table 8 compares the test results of the 7,500 samples and shows low sensitivity of the donor blood screening system (i.e., low detection capacity of contaminated samples) in the surveyed blood centers. *However, caution should be used when assessing these results due to the limited number of samples included in the sensitivity analysis, particularly for the HIV testing.*

Calculation of a more precise estimate of the sensitivity would require a larger sample, which was beyond the resources available for this assessment. Low specificity of the tests should also be a concern for the governments in this regions, particularly given the limited availability of donated blood.

Beyond the concerns articulated above, it could be concluded that the current screening for blood borne pathogens of donated blood in Central Asia may be providing a false sense of security as the risk of receiving an infected blood unit and acquiring a transfusion-transmitted infection in the countries of the region is real. More ominous is the fact that some health facilities in Central Asia do not test blood donations at all. The information generated by this assessment may serve as an initial baseline for future assessments.

Table 8. Comparison of donor blood screening results in blood center and reference laboratories

Markers	Number of positive samples		Sensitivity
	Reference laboratories	Blood centers	
Anti-HIV	11	6	54.5%
Anti-HCV	228	182	79.8%
HBsAg	200	121	60.5%
Anti-Syphilis	267	52	19.5%

Given that blood samples are tested for markers of several infections, not all false-negative blood donations were sent to health facilities: in many cases samples were rejected based on the presence of another marker for parenteral infection (Table 9). The total number of blood donations infected with HIV, hepatitis B and C, or syphilis sent to health facilities was **308 or 4.1 percent** of the 7,500 total.

Table 9. Contaminated blood or blood components distributed to health facilities versus discarded (n = 706), by marker

Donor blood distribution (blood center laboratories)	Markers detected in donor blood samples (reference laboratory)				Total
	Anti-HIV	Anti-HCV	HBsAg	Anti-Syphilis	
Blood or blood components sent to health facilities	2	39	74	193	308
Blood donations discarded by blood centers due to contamination	9	189	126	74	398
Total	11	228	200	267	706

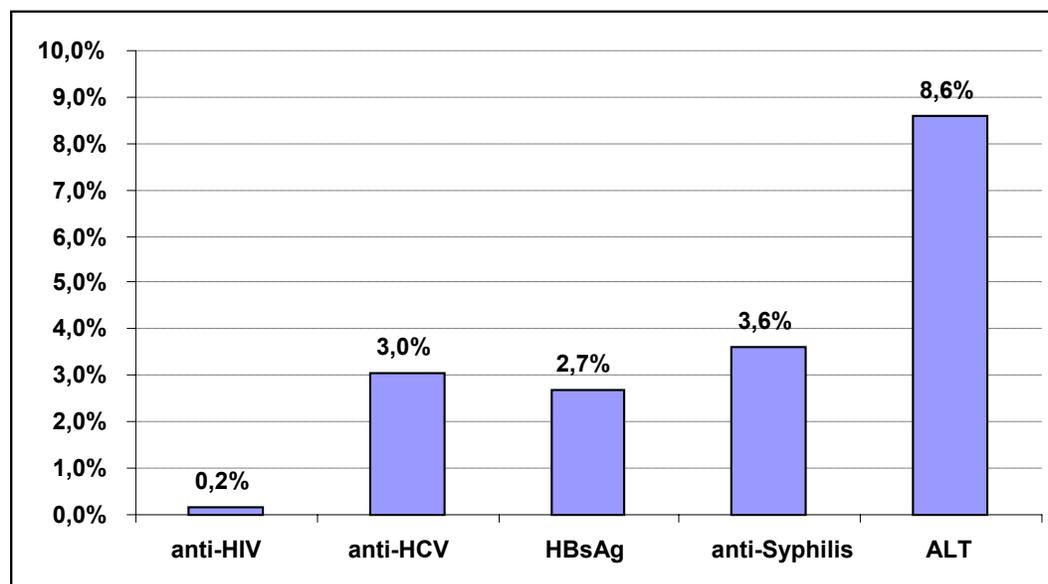
3. Level of infection among blood donors

Evaluating communicable diseases rates in blood donors is essential for monitoring the safety of the blood supply and donor screening effectiveness.⁷⁰ As shown in Figure 4, the re-testing of the 7500 blood samples carried out by the CDC/CAR team found a prevalence of communicable diseases of 0.20 percent for HIV, 2.7 percent for hepatitis B, 3.0 percent for hepatitis C, and 3.6 percent for syphilis. ALT tests were also performed to double check if donors with acute viral hepatitis were in the “window” stage-- when markers for the disease are still not detectable. The tests found a prevalence of 8.6 percent for ALT elevation, signaling the potential residual risk of transmission of viral diseases during the window period. In determining blood service operational safety, Hepatitis C prevalence can serve as a proxy indicator for the recruitment of injecting drug users into the donor pool. (In Kazakhstan, for example, sentinel surveillance in 2005 determined a hepatitis C prevalence of only 1.4 percent among pregnant women, reflecting the general population, while among injecting drug users it was 63.1 percent). A successful intervention in donor recruitment should result in a hepatitis C prevalence equivalent to approximately half the current value (1.5 percent). It should be noted that a safe donor pool is expected to show lower infection marker prevalence than the general population.

These findings underscore the need to strengthen screening of blood donors for each donation and strengthen other prevention and control measures to guarantee the safety of the blood supply in the health systems of the Central Asia countries, to reduce the potential risk of involuntary infection to the unsuspecting population.

⁷⁰ Glynn, S.A., et al. “Trends in incidence and prevalence of major transfusion-transmissible viral infections in US blood donors, 1991 to 1996.” JAMA 284 (2000):229-235.

Figure 4. Prevalence rate of cases of anti-HIV, anti-HCV, HBsAg, anti-Syphilis, and ALT among blood donors (N=7500)



4. How have governments responded to the findings of this assessment?

The results of the CDC/CAR survey were shared with Ministry of Health authorities in the Central Asian countries in 2007 as soon as the data became available, as was done with the results of similar assessments since 2004. On the basis of the evidence presented, some initial measures have already been adopted with the support of international organizations, as follows:

- Legal and regulatory measures have been issued and adopted in some countries.
- Centers that were not using questionnaires to identify behavioral risk factors among potential donors are now starting to use them.
- State-of-the-art laboratory equipment has been installed in two republican blood centers.
- Blood centers that used re-usable glass bottles and vials have started using disposable bags for all blood donations. Moreover, in accordance with CDC/CAR recommendations, blood centers doing routine screening use standardized ELISA test-kits registered in Central Asia instead of inappropriately manufactured tests.
- Training workshops have been organized on (i) blood safety with the involvement of international specialists, for laboratory workers specializing in quality control issues; (ii) epidemiological aspects of blood safety for epidemiologists; and (iii) blood banking and the use of blood in clinical settings for medical personnel. Also, six courses have been conducted in these countries for blood service specialists (180 attended); three courses for epidemiologists (48 attended); and five courses for transfusion technicians (215 attended).
- Additionally, national guidelines on the clinical use of blood and blood products are now being revised.

5. Ongoing support from international agencies

Several international organizations, both technical and financial, are now supporting the Central Asian countries to address some of the shortcoming in the blood services as follows:

- CDC/CAR is the key regional partner helping these countries to develop their national blood policies and programs, working with Ministries of Health, non-governmental organizations, and other international agencies. With the support of the United States Agency for International Development (USAID) and World Bank-funded Central Asia AIDS Project (a regional initiative approved in 2005 covering four countries), CDC/CAR is working to strengthen HIV surveillance, control, and prevention and to reduce the risk of HIV transmission through blood transfusion throughout Central Asia.
- USAID is also supporting related public health efforts in the region. Recently, it funded a study tour for health professionals and a representative from Kazakhstan's Ministry of Health to travel to the United States to learn about HIV prevention programs, infection control regulations, and blood bank services. USAID's regional health reform project introduced HIV prevention, safer sex counseling and correct use of condoms through training on effective perinatal care standards in 53 maternity post-partum departments, post-abortion departments, and PHC facilities. The training also included sessions on universal precautions to improve injection safety, indicate judicious use of blood and blood products, and promote the use of new interventions to reduce post-partum hemorrhage and the subsequent need for blood products. The program continues to support the implementation of these precautions, and to introduce them into additional clinical settings.
- The Asian Development Bank (ADB) and the Global Fund to Fight AIDS, TB and Malaria are major international funding agencies working with the national AIDS authorities in Central Asia to strengthen transfusion services. ADB's projects in Tajikistan and Uzbekistan include components to ensure adequate HIV/AIDS response in the primary health care systems and strengthen community support for safe blood supplies.
- With the support of its country offices and in consultation with Ministries of Health, WHO continuously maps activities and progress in the field, coordinating its efforts with various stakeholders and interested parties to support and enhance the reform of blood services in the Central Asia Region (CAR). Particular emphasis is given to capacity-building towards strengthening quality and safety of the CAR blood supply. Training sessions have been organized in various fields (bio-safety, quality of testing, use of blood, overall quality management), and two interactive training toolkits made available in Russian. Following on assessment missions (2006/2007), the 2008-2009 biennial collaborative agreements with all Central Asian republics foresee the continuation of the capacity building process, including safe blood donation programs.
- A new World Bank-funded project in Kazakhstan (Health Sector Technology Transfer and Institutional Reforms Project), approved in 2008, also includes investments to support reforms and improvements in the country's blood transfusion system.

CHAPTER IV: RECOMMENDATIONS TO IMPROVE BLOOD SERVICES IN CENTRAL ASIAN HEALTH SYSTEMS

This report has discussed some of the systemic deficiencies currently affecting the blood transfusion services in the health systems of Central Asian countries. Organizational problems and limited financing, blood collection from unsafe donors, outdated equipment and inadequate blood-testing materials, insufficient numbers of trained staff, poor laboratory practices, and outdated practices of blood use contribute to the risk of an unsafe blood supply that puts the populations of these countries at risk for communicable diseases and blood supply shortages.

Additional and sustained medium-term efforts need to be undertaken by Central Asian governments with the coordinated support of international agencies such as WHO, CDC/CAR, the World Bank, the ADB, and the Global Fund, to address the observed deficiencies in blood services. To maximize effectiveness, these efforts must be integrated with ongoing and future reform programs to strengthen the organization, financing, and delivery of health care services in these countries. To this end, the WHO health systems framework with its four functions (stewardship, resources, services delivery, financing) should be used in designing interventions for better efficiency and long-term sustainability.^{71 72 73} The recent rapid spread of HIV, which is largely fueled by intravenous drug use and unsafe sexual practices and linked to increasing cross-border movement, heightens the urgency to address this “clear and present danger.”

In many parts of the world, blood transfusions are no longer a significant source of HIV, hepatitis B and C, or syphilis infection, as governments have implemented strategies to improve the safety of both the blood supply and the administration of blood. Central Asian countries urgently need ***political commitment and leadership at the highest levels of government*** to strengthen basic public health systems, including blood services, as key investments to prevent and control the spread of these diseases. A set of recommendations are presented below to help advance the public health agenda in Central Asia by ensuring blood transfusion safety in the region. However, unless these measures are implemented systematically and sustained over the medium term, ***with regular monitoring of progress incorporated as part of quality control activities***, the availability and safety of blood for transfusions in Central Asia will remain unsatisfactory and dangerous for the population.

A. Develop national blood program and improve its stewardship

- ▶ Existing ***laws, regulations and norms*** that provide the legal framework for blood banking and transfusion medicine in Central Asia should be revised and adjusted in accordance with international practices and WHO standards and guidelines. Particular attention, however, needs to be placed on ensuring their proper enforcement.

⁷¹ WHO. *Everybody's Business, Strengthening Health Systems to Improve Health Outcomes. WHO's Framework for Action*, Geneva: WHO, 2007.

⁷² Murray, C.J.L., and J. Frenk, “*A Framework for Assessing the Performance of Health Systems*,” *Bulletin of the World Health Organization* 78(2000):717-731.

⁷³ Reich, M.R., K. Takemi, M.J. Roberts, and W.C. Hsiao, “*Global Action on Health Systems: A Proposal for the Toyako G8 Summit*,” *The Lancet* 371(2008):865-869.

- ***A nationally coordinated blood transfusion service, with a unified management structure and trained personnel***, accountable to the Ministries of Health and integral to the health care system, should be developed. This would require revision of organizational and managerial structures and processes, as well as the development of strategies and plans to reduce the number of blood banks to achieve economies of scale.
- ***A universal, unpaid blood donor system*** should be established to reduce the risk of unsafe blood transfusion. As shown elsewhere, one important public health measure that needs to be adopted in Central Asia is to reduce and ultimately stop payment for blood donations and focus on voluntary donors who are the least likely to transmit infectious agents. The blood supply should come exclusively from voluntary, unpaid donors from low-risk populations. Particular emphasis should be placed on assessing the perceptions and concerns of Central Asians regarding blood transfusions. There is also a need to work with mass media to develop targeted education and promotion campaigns to motivate, recruit, and retain low-risk donors. Effective programs to promote voluntary blood donations involve ***social mobilization*** at both the grass roots and national levels. To this end, partnerships with communities, local organizations and religious and community leaders need to be established.
- Effective ***donor screening*** strategies, including routine questioning about high-risk behaviors (standardized self deferral questionnaire), are underused in this region and their inclusion into daily practice should be supported as a top priority.
- Support should also be provided to assist each of the Central Asian countries to develop ***national donor registries***, supported by information technology (IT) systems linking blood centers, reference laboratories and hospital users. This is a key investment as the existence of a functioning centralized data registry of blood donors allows the deferral of volunteers who have previously tested positive for any communicable diseases under surveillance.⁷⁴
- ***Building awareness at two levels: the medical profession through training and continuous medical education, and the general public through appropriate information campaigns, is integral to the success of blood services.*** Two of the main problems associated with blood transfusions are misperceptions around their indications, and people's ignorance of their potential risks. Physicians in many developing countries (and Central Asian countries are no exception to this) often prescribe a blood transfusion under the misconception that it will assist the patient by remedying a particular condition/disorder. On the other hand, many patients associate blood transfusion with modern healthcare and even go to the extent of demanding it, which also affects the attending physician's behavior (due to his/her desire to keep patients and thus attempt to provide care that converges with patients' beliefs). To address this issue, governments should develop appropriate information campaigns to build public awareness of the fact that transfusions may pose some risks, and are medical procedures subject to clear indications. Significant efforts are also needed to improve pre-service medical education at the undergraduate and post-graduate levels.

⁷⁴ G. A. Schmunis and J. R. Cruz, "Safety of the Blood Supply in Latin America," *Clinical Microbiology Reviews* 18(1) (2005): 12–29.

B. Address chronic under-financing of blood transfusion services

- The allocation of existing *budgetary resources* should be substantially increased to support the effective operation of restructured blood transfusion services. A negotiated fee schedule for blood and blood products, based on non profit operations should be calculated and agreed between the Ministry of Health, hospital administrators, and blood transfusion services. The fees should be covered by social health insurance or voluntary health insurance reimbursements to the health facilities administering these services.

C. Improve the quality of transfusion services and related medical practice

1. Blood service sites

- ***The infrastructure and equipment/ technologies in the blood center should be improved and upgraded, and dedicated staff assigned and trained***

Particular attention needs to be given to the refurbishment of existing blood services, following the redistribution of task according to the system reform. This applies to both functionality and safety requirements applicable from the site of donor selection, collection, testing, processing and storage of blood and blood components.

Particular emphasis must be given to testing procedures, including revision and update of current policies, regulations and diagnostic algorithms, as well as, norms, standards, and guidelines for screening of donated blood. Inclusion of internal quality control in regular practice and participation in programs of external quality assessment at national and international levels should be foreseen.

Adequate staff expertise is a prerequisite for a well-functioning system. Regular training programs, including proficiency testing in the principles of quality management, (including quality assurance and quality control), should be organized for all staff, and particularly laboratory specialists.

- ***A centralized procurement arrangement for the blood service is required to ensure consistency and foster economies of scale***

Mandatory standard guidelines should be developed and adopted for the purchase of dedicated equipment and supplies (e.g. blood bags, injection devices, gloves etc; reagents and test kits, etc) and support provided for training the staff responsible for procurement of goods and services in the blood transfusion centers. These measures would help standardize procurement procedures and ensure that those responsible for procurement are adequately trained.

The purchasing procedures should be supported by appropriate regulatory mechanisms, ensuring registration and validation of both equipment and supplies purchased.

Increased attention must be given to the quality of tests in use. Tests should be registered at national level, controlled and validated by the national regulatory authority. In addition, regular checks per batch must be performed at purchaser level to ensure even quality.

To reduce the high cost of screening assays, cost-effective selection of methodologies and assays, including pooled testing arrangements should be developed. Governments

could consider eliminating import duties on essential laboratory equipment and supplies through development of local sources based on technology transfer and innovation.

- ***Quality management systems should be implemented to ensure safe blood donation and use.***

Quality management systems should cover the whole blood chain, from the potential donor pool to the potential recipient, including follow-up programs for monitoring and evaluation of all related blood banking activities in accordance with WHO guidelines.

Sensitive screening tests and a mandatory quality assurance system are essential for ensuring the safety of the blood supply.⁷⁵ However exhaustive control over the entire blood source, stock and transfusion process by developing protocols, documenting procedures, techniques, reagents, equipment use and maintenance, and participation in performance evaluation programs that enable periodic assessments of their suitability is required.⁷⁶ Dedicated training, functional reporting systems and provision of feedback information for improvement actions when and where necessary are part of the process.

- ***Modern medical waste management systems (including biohazard waste and sharps) should be implemented as part of the bio safety policies.***

Current working conditions and practices in blood services and health care facilities should be assessed and improvements undertaken. Dedicated regulations and specific procedures must be revised, with emphasis on handling, disinfection/ decontamination, and internal/ external disposal processes.

Training of personnel and continuous education must be supported by organizational measures and provision of adequate equipment (e.g. autoclaves, needle cutters, incinerators etc).

2. Hospital sites

- ***The rational use of blood and its products should be promoted, as part of the key measures addressing quality, safety and self sufficiency of blood therapy***

Outdated guidelines and practices should be revised and updated, using existing scientific evidence of transfusion therapy efficiency and adapting international recommendations to the local context. This would require the involvement of international experts to support the work of local specialists. These standards and clinical guidelines should be developed in accordance with WHO recommendations and be applicable to national blood transfusion services.

Reducing blood usage through adequate clinical indications, appropriate patient management and autologous blood transfusion (transfusion of own blood as an

⁷⁵ D. A. Voak et al., "Affordable Safety for the Blood Supply in Developed and Developing Countries," *Transfusion Medecine* 8 (1998): 73–76.

⁷⁶ G. A. Schmunis et al., "Risk of Transfusion Transmitted Infectious Diseases in Central and South America," 1998.

alternative to allogeneic blood transfusion when patient receives blood from a donor) should be promoted in Central Asian health care.^{77 78}

Clinicians should undergo continuous education programs and be trained in the different methodologies that can be considered, such as: 1) pre-operative blood collection for autotransfusion; b) intra-operative normo-volemic haemodilution; or c) pre or post operative blood salvage.

Pre-operative autologous donation of blood (PAD) for possible transfusion back to the patient (who is her/himself the donor) can be performed in the case of elective surgery. Evidence shows that PAD could reduce the likelihood (and associated risks) of receiving allogeneic blood transfusion by 64% (Relative Risk=0.36; 95%CI 0.25-0.51). However, this procedure should be considered with care, as it involves special organizational measures, patient must comply to specific medical criteria to undertake the process, and autologous units will undergo customary testing and be transfused only in case of need.

- ***A hemovigilance system for monitoring adverse effects and incidents along the blood chain, including transfusion outcomes, should be established.***

The hospital transfusion committees, as entry points for monitoring, evaluating and discussion of transfusion therapy indications, efficiency and related adverse events serve as key structures for an operation haemovigilance system.

Reporting guidelines for adverse events and standardized forms need to be developed and data collected, analyzed and discussed at institutional level, in the first place. Linked with the national epidemiological surveillance systems, it should play a critical role in policy formulation, program development, and the adoption of adequate measures for controlling the spread of communicable diseases and increasing patient safety and quality of care.

D. Strengthen preventive public health and primary health care programs to reduce the supply-demand gap for blood transfusion.

The Central Asian countries could tackle the gap between blood supply and demand through different mechanisms. Developing effective public health programs that focus on remedying the causes of conditions/disorders requiring blood transfusion therapy and enforcing the role of the primary health care level will strengthen prevention and early diagnosis. For example, prevention of anemia, improvement of prenatal care and “safe motherhood” initiatives can reduce the need for peripartum transfusion – the main indications for blood transfusion in the developing world. Also, chronic anemia in children may be best addressed by improving nutritional status and health standards rather than transfusing blood, which in this case would treat only symptoms, not causes. This integrated course of action should also be highlighted in the national blood program and particularly emphasized when developing algorithms for clinical decision making for physicians.

⁷⁷ Henry D.A. et al. “Pre-operative autologous donation for minimizing perioperative allogeneic blood transfusion”. Cochrane Database of Systematic Reviews Issue 2, 2002.

⁷⁸ Carless P.A. et al. Cell salvage for minimising perioperative allogeneic blood transfusion. *Cochrane Database of Systematic Reviews* Issue 4, 2003.

E. Foster regional communication and collaboration arrangements among the Central Asian countries

Recognizing the increasing importance of regional integration and cooperation for economic and social development among the Central Asian countries, regional communication and collaboration arrangements are necessary to facilitate the exchange of information on experiences and good practices, as well as horizontal sharing of expertise and technical assistance. Collaboration among the Central Asian countries in this field is necessary given the limited human resource capacity available in the region, the uneven distribution of financial and institutional capacity to address public health challenges that transcend national borders, and the regional and cultural similarities. Regional arrangements would facilitate trans-national availability of safe blood for medical emergencies and special circumstances, as well as the availability of rare blood group donations.

F. Are these interventions cost-effective?

Given the current state of the HIV epidemic in Central Asia, as well as the high rates of hepatitis B and C, and syphilis, prevention of these diseases should be a priority for the governments in this region. The costs of delaying action can be onerous as already shown elsewhere.⁷⁹

Improving blood safety is a high-priority intervention as the transfusion of contaminated blood or blood products is an efficient way of spreading these diseases. As noted above, *the transfusion of HIV-infected blood is the most efficient means of transmission: about 100 times more efficient than intravenous drug injection with a contaminated syringe (according to available evidence, risk of HIV transmission through blood transfusion is 9,250 per 10,000 exposures to an infected source⁸⁰).*

Fortunately, it is possible to block this mode of transmission. Investing in the safety of blood and blood products is extremely cost-effective. And, available evidence from different settings supports WHO and UNAIDS recommendations that all countries, regardless of the nature of their HIV epidemic, should implement a comprehensive blood safety program.⁸¹

Currently, the average cost of the EIA test for detecting the presence of HIV antibodies in the blood can be as low as US\$1 in a well-run laboratory in a developing country which performs large numbers of such tests. Assuming US\$1 per test for management overhead (the typical range is US\$0.80 to US\$2), the average total cost of such a test can be US\$2. In rural areas, the alternative rapid serologic tests for HIV that do not require refrigeration cost an average of US\$4 per test, which becomes US\$5 with the addition of operating costs.⁸² The cost of the test kits for hepatitis B (average US\$0.60 to US\$1.50) and C (average US\$2.5 to US\$6), as well as for syphilis, has also been reduced significantly in the last decade. Although the overall amount

⁷⁹ O. Adeyi et al. *Averting AIDS Crises in Eastern Europe and Central Asia* (Washington, D.C.: The World Bank, 2003).

⁸⁰ Baggaley RF et al. "Risk of HIV-1 transmission for parenteral exposure and blood transfusion: a systematic review and meta-analysis." *AIDS* 20 (2006):805-812.

⁸¹ *Ibid.*

⁸² Jamison, D.T. et al. *Disease Control Priorities in Developing Countries*. New York: World Bank and Oxford University Press, 1993.

depends on country specific costs (the cost of tests varies in different countries) and the type of blood products, according to WHO, one unit of safe blood costs approximately US\$50 to produce (this includes recruitment of safe donors, screening, blood grouping, processing into components, storage and transportation). Assessment of the cost-effectiveness of screening would require an estimate of the cost of blood screening per averted infection, multiplying the screening cost by the number of units that would need to be screened to avert each infection. That figure would be compared with the lifetime cost of treating HIV, hepatitis and syphilis transfusion-infected patients (appropriately discounted). Treatment costs for AIDS are high, despite reductions in antiretroviral (ARV) prices in recent years. The current price for ARV drugs varies from US\$500 to US\$5,000 per patient per year (currently some of the more costly second line drugs are not available in Central Asia). In addition to the cost of ARV drugs, the cost of diagnostic services (e.g., laboratory tests), hospital care, and other costs related to patient follow up need to be included. Similarly, the cost of drugs for treating patients infected with Hepatitis B and C maybe unaffordable in low income countries, at US\$10,000-US\$15,000 per year for Hepatitis B (mostly not available in Central Asia), and US\$20,000-US\$25,000 per year for Hepatitis C (currently not available in Central Asia). The cost of treating a syphilis case is about US\$5-US\$50.

The establishment of a well-functioning blood service that ensures the safety of the blood supply in a country, coupled with the reduction of unnecessary and inappropriate transfusions, would result therefore not only in lower incidence of transfusion transmissible diseases, including the significant reduction of HIV transmission through transfusions, but would also have a positive financial and economic welfare impact.

THE WAY FORWARD

Recent international experience shows that a balanced combination of prevention, treatment, and care, as well as institutional capacity building is required to ensure an effective and sustainable response to arrest the spread of communicable diseases, both at the country and international levels. Following a “diagonal” approach that avoids the false dichotomies of prevention versus treatment and horizontal versus vertical programs, efforts to address the threat of communicable diseases including AIDS provide an opportunity to strengthen health systems and mobilize political commitment and financial resources that are vital for supporting improvements in health outcomes and achievement of the MDGs.

Controlling blood transfusion-transmitted communicable diseases is a key public health issue in Central Asia, as underscored by the findings presented in this report. Ensuring the safety of the blood supply, however, is a particularly difficult challenge in countries with a low national income and weak health systems. As argued at the beginning of this report and fully consistent with the health improvement and poverty alleviation objectives of the World Bank’s work in the health sector, efforts to address the systemic deficiency of blood transfusion services in Central Asia should be part of broader health system strengthening programs and activities.

Continuous collection, analysis, and dissemination of the type of information presented here, information not previously available in Central Asia, are critical actions for mobilizing government and general public support to ensure the quality of a blood supply as an integral part of health system restructuring processes. These efforts are also consistent with the new strategic directions guiding the overall work of the World Bank, particularly the need to support regional and global public goods that transcend national boundaries in close cooperation with other agencies with specialized expertise, such as the WHO, UNAIDS, and U.S. CDC.

Concerted action by the Central Asia governments and regional organizations in meeting this challenge, with the assistance of the international community, will help to mitigate the adverse impact of communicable diseases on people of the Central Asian region in the years to come.

ANNEX 1: STATUS OF HEALTH-RELATED MDGS IN CENTRAL ASIA

MDG related health indicators	Kazakhstan		Kyrgyzstan		Tajikistan		Turkmenistan		Uzbekistan		MDG targets
	1990	Latest Figure	1990	Latest Figure	1990	Latest Figure	1990	Latest Figure	1990	Latest Figure	
<i>Infant mortality per 1,000 live births</i>	54	63 (WDI, 2005)	69	58 (WDI, 2005)	57	59 (WDI, 2005)	80	81 (WDI, 2005)	47	57 (WDI, 2005)	Reduce by two-thirds, between 1990-2015, the under-five mortality rate
<i>Under-five mortality rate per 1,000 live births/year/source</i>	63.0	73.0 (WDI, 2005)	80.0	67.0 (WDI, 2005)	119.0	71 (WDI, 2005)	97.0	104 (WDI, 2005)	79.0	68 (WDI, 2005)	
<i>Maternal mortality ratio per 100,000 live births</i>	80 (UN MDG database, 1990)	210 (UN MDGs database, 2000)	110 (UN MDGs database, 1990)	110 (UN MDGs database, 2000)	130 (UN MDGs database, 1990)	100 (UN MDGs database, 2000)	55 (UN MDGs database, 1990)	31 (UN MDGs database, 2000)	55 (UN MDGs database, 1990)	24 (UN MDGs database, 2000)	Reduce by two-thirds, between 1990-2015, the maternal mortality ratio
<i>HIV Infection rates per million people</i>	2.9 (1996)	48.4 (WDI, 2003)	0.4	25.3 (WDI, 2003)	0.0	6.7 (WDI, 2003)	N/A	< 0.1	0.0 (1996)	70.4 (2003, ECEM AIDS)	Have halted by 2015 and begun to reverse the spread of HIV/AIDS
<i>Incidence of TB per 100,000</i>	57.3	144 (WDI, 2005)	52.1	121 (WDI, 2005)	107.4	198 (WDI, 2005)	59	70 (WDI, 2005)	46.1	113 (WDI, 2005)	Have halted by 2015 and begun to reverse the incidence of malaria and other major diseases
<i>Reported malaria cases (annual)</i>	N/A	N/A (GFATM, 2008)	1	468 (GFATM, 2008)	175	5,428 (GFATM, 2008)	1	N/A (GFATM, 2008)	28	74 (GFATM, 2008)	

Data sources: United Nations Statistics Division; World Development Indicators (WDI); World Malaria Report 2005; World Health Organization Health For All Database; World Health Organization Reproductive Health Database; World Health Organization, Global Tuberculosis Database; UN Common Database/UNICEF; UN MDGs Statistical Database; European Centre for the Epidemiological Monitoring of AIDS (ECEM AIDS).

Definitions of Indicators are on the next page.

DEFINITIONS OF INDICATORS

Infant mortality is the number of infants, out of every 1,000 babies born in a given year, who die before reaching age 1.

Under-five mortality rate is the probability, expressed per 1,000, that a newborn will die before reaching age five. It is an “expectation” based on current annual rates. It is therefore not an observed rate of child deaths in their first five years, rather a probability of a child dying in the reference year, assuming that current mortality pattern continue to apply.

Maternal mortality ratio is the number of women per 100,000 who die during pregnancy or childbirth.

Prevalence of HIV is the percentage of people ages 15-49 infected with HIV

HIV infection rate is the estimated number of new cases of HIV per million people.

Incidence of TB is the estimated number of new cases (pulmonary, smear positive, extra-pulmonary) per 100,000 people.

Reported malaria cases – Reported annual cases of malaria.

Source: World Bank. Millennium Development Goals. Progress and Prospects in Europe and Central Asia. Washington, DC: World Bank, 2005.

ANNEX 2: METHODOLOGY FOR ASSESSING ACCURACY OF BLOOD SCREENING IN CENTRAL ASIA

This annex describes the methods, equipment, and materials used to test blood in blood center laboratories to test the reliability of those tests in the surveyed Central Asian countries.

1. Routine screening of donor blood sera samples in blood center laboratories

Use of test-kits for routine screening by blood center laboratories

Blood samples under consideration (n=5,000) were tested at the two republican blood center laboratories with enzyme immunoassay (EIA or ELISA) methods for markers of parenteral hepatitis using locally produced test-kits, which are used in routine practice. To detect markers of HIV infection, test-kits from a Russian manufacturer, Vector Best, Novosibirsk, were used. To test for syphilis, the laboratories used the micro-reaction (Wassermann) test.

Considered samples from the oblast blood center laboratory (n=2,500) were tested by the ELISA method with Russian-produced test-kits:

- anti-HIV: CombiBest anti-HIV-1,2
- anti-HCV: RecombiBest anti-HCV with RecombiBest anti-HCV confirmatory
- HBsAg: Vectogep B-HBs antigen (manufacturer: Vector Best, Novosibirsk) with Vectogep B-HBs antigen confirmatory
- anti-Syphilis: RecombiBest anti-pallidium-summary antibodies

Quality assurance and control of tests done in the oblast blood center laboratory

Inspection tests of test-kits for HIV diagnostics were performed with a commercial control panel of serum containing antibodies to HIV-1. Manufacturer: CJS Medical-biological Union, Novosibirsk city. A control test had been done for each series of test-kits. Test-kits, with control results that complied with standard requirements, were used in testing the samples for this study.

Inspection tests of test-kits for syphilis diagnostics were performed with a commercial control panel of serum containing and not containing antibodies to *Treponema pallidum*. Manufacturer: CJS Medical-biological Union, Novosibirsk city.

Inspection tests of test-kits for diagnostics of viral hepatitis B and C were not performed due to the lack of a control panel.

Internal laboratory quality control tests were performed daily in adherence to internal laboratory control materials for anti-HIV (prepared according to WHO recommendations).

Results of EQA performed by RAIDSC in 2005 showed that anti-HIV test accuracy in the oblast blood center laboratory was 100 percent, for anti-HCV 87 percent, and for HBsAg 75 percent.

2. Screening of donor blood sera samples in the reference laboratories under the survey

For comparative assessments of test accuracy of the blood center laboratories, the study used a method of encoded re-testing (blind rechecking method). Blood center test results for each sample were compared with test results of the same sample in the reference laboratories.

This section presents laboratory data of the three surveyed blood center laboratories given that screening was performed based on one algorithm. Re-screening of the same donor blood sera samples (n=7500) was done in the national reference laboratories in three stages:

Stage I: The study screened 7,500 donor blood sera samples by EIA method using Russian-made test-kits. Test-kits for the EIA of the companies listed below are licensed by the country producer and are formally registered in the Central Asian countries:

- anti-HIV: Recombinant HIV 1,2 (DSM, Novosibirsk) and EIA-anti-HIV-unified for detection of anti-HIV-1 and HIV-2 (DS, Nizhnyi Novgorod).
- anti-HCV: RecombiBest anti-HCV (Vector-Best, Novosibirsk) and HCV-DSM, HCV-DSM – confirmatory (Manufacturer: MBS, Novosibirsk city)
- HBsAg: DS-EIA-HBs antigen (Diagnostic Systems, Nizhnyi Novgorod) and Vektogep B – HBs antigen strip (Vector Best, Novosibirsk city)
- anti-Lues: Syphilis DSM summary: (MBS, Novosibirsk) and EIA-anti-Syphilis (Diagnostic systems, Nizhnyi Novgorod city).

Stage II: All positive blood samples were re-tested to exclude false-positive results. In addition, 10 percent of the negative samples were retested for quality control given the lack of false-negative results in Stage I. Screening was based on the EIA method with the use of test-kits that had been certified by WHO (expert test-kits):

- anti-HIV: Murex HIV-1.2.0. Manufacturer: Murex Biotech Limited, USA
- anti-HCV: Murex anti-HCV, Version 4.0. Manufacturer: Murex Biotech Limited, USA
- HBsAg: Murex HBsAg, Version 3. Manufacturer: Murex Biotech Limited, USA
- anti-Luis: ISE* Syphilis. Manufacturer: Murex Biotech Limited, USA

Stage III: Samples in which the presence of an anti-HIV marker was detected by an expert test-kit were confirmed by immunoblot: Naw LAV BLOT I. Manufacturer: BIO-RAD, USA.

Quality assurance and control of reference laboratory tests

The quality of results was ensured by following rules and standard operating procedures within all laboratory screening stages (pre-analytical, analytical, and post-analytical) and was controlled through observation of the internal laboratory quality control program, including:

- performing inspection tests of test-kits for anti-HIV, anti-HCV, and HBsAg
- using internal laboratory standards for each test to detect an intolerable level of error and assess the accuracy of the tests.

The use of this internal (to the laboratory) quality control system makes it possible to ensure that the results are reliable.

Quality control of incoming test-kits was done by using the reference panel developed in the reference laboratory of the Republican AIDS Center in Kazakhstan, in accordance with WHO recommendations (*Requirements and Guidance for External Quality Assessment Schemes for Health Laboratories*, WHO/DIL/LAB/99.2). The samples were collected from residents of Kazakhstan. All samples proposed to be used for the reference panel were preliminarily tested for anti-HIV, anti HCV, and HBsAg by ELISA test-kits recommended by WHO (Ortho-HIV1/HIV2 Ab-Capture, Ortho-HCV 3.0, Ortho-HBsAg (Ortho-Clinical Diagnostics, USA) with consecutive confirmation by Western blot New LAV Blot 1.

Inspection tests in the reference laboratory of another republic were performed only with regard to test-kits for anti-HCV and HBsAg. Reference panels of sera prepared in the reference laboratory dealing with diagnostics of viral infections were used as inspection tests for the test-kits used. No inspection tests were done with regard to test-kits used to detect antibodies to HIV due to the lack of a panel of standard sera.

Values equal to or above the cut-off for optical density (OD) were calculated according to application sheets attached to test-kits and were considered to be positive, i.e., containing the markers under consideration. Sensitivity of the test-kits used was defined as 100 percent, given that all positive samples of available standard panels were identified as positive. Values below the cut-off OD were considered to be negative, i.e., free of the markers under consideration.

Detection of random errors and systematic inaccuracies when performing anti-HIV EIA-based tests was done on the basis of internal laboratory positive standards and were taken into account when developing the “Levey-Jennings Control Chart” using Westgart rules. Control instrumentation data showed that no errors were made during screening and confirmed the accuracy and adequacy of test results.

3. Assessment of screening accuracy of blood center laboratories

For comparative assessment of screening accuracy of the laboratory blood service, encoded re-testing method (blind rechecking method) was used, whereby test results of each of the samples from the laboratories were compared with the test results of the same encoded samples tested in the reference laboratories. The results were assessed based on sensitivity and specificity, which were determined as follows:

Blood center laboratory	Marker (+)	Marker (-)
	Test (+)	True positive A
Test (-)	False negative C	True negative D

Sensitivity: ability of the blood center laboratory to detect true positive results.

$$\text{Formula: } A / (A+C) \times 100\%$$

Specificity: ability of the blood center laboratory to detect true negative results.

$$\text{Formula: } D / (D+B) \times 100\%$$

Case definition

- ❖ HIV positives were considered to be donors whose positive screening and expert EIA tests were confirmed by immunoblot.
- ❖ HBsAg, anti-HCV, and anti-Syphilis positive were considered to be donors whose positive results of EIA-based screening test were confirmed by an expert EIA test.

Data input and processing

A database was created based on the outcomes of blood donors’ questionnaire-based interviews. Statistical analyses of demographic data and risk factors of donor infection were performed with EpiInfo 2000 software.

ANNEX 3: QUESTIONNAIRE: BLOOD DONOR INFORMATION

1. Blood donation date {**dataint**} <dd/mm/yy>
2. Number of the blood serum sample {**Unique Key**} #####
3. Blood group {**bloodGr**} # (1-I; 2-II; 3-III; 4-IV)
4. Rhesus factor {**RhesusBl**} # (1-positive; 2-negative)
5. Age {**age**} ##
6. Education {**Educat**} # (1-higher; 2-secondary; 3-primary)
7. Sex {**sex**} # (1-male; 2-female)
8. Residence place {**urbanrur**} # (1-city; 2-rayon)
9. Family status (**familyst**) # (1-single; 2-divorced; 3-widow/er; 4-married)
10. Occupation {**Occupat**} # (1-has regular job; 2-unemployed)
11. Donor view {**viewdonor**} # (1-paid; 2-unpaid; 3-donor-relative)
12. Donor type {**Typedonor**} # (1-blood donor; 2-plasma donor)
13. Donation experience {**Howyear**} # (1-less than 1 year; 2-from 1 to 5 years; 3-more than 5 years)
14. Blood collected into {**Deliverable**} # (1-blood bags; 2-multiple-use vials)
15. Had manipulations in health facilities in the last 2 months {**medical**} # (1-yes; 2-no)
16. Has tattoo {**Tatoo**} # (1-yes; 2-no)
17. Has commercial sex relations {**Happensex**} # (1-yes; 2-no)
18. Skills of intravenous manipulations {**Introvenous**} # (1-yes; 2-no)
19. Use of blood after laboratory screening # {**Useblood**} (1-given to the health facility; 2-discarded)

Results of screening in the laboratory of Blood Center – EIA

20. Anti-HIV {**anti-HIV**} # (1-positive; 2-negative)
21. Anti-HCV {**anti-HCV**} # (1-positive; 2-negative)
22. HbsAg {**HBsAg**} # (1-positive; 2-negative)
23. Anti-Syphilis {**anti-Syphilis**} # (1-positive; 2-negative).

Results of screening in the reference-laboratory (Russian test-kits) -EIA

24. Anti-HIV {**HIV-Rus-RL**} # (1-positive; 2-negative)
25. Anti-HCV {**HCV-Rus-RL**} # (1-positive; 2-negative).
26. HBsAg {**HBsAg-Rus-RL**} # (1-positive; 2-negative)
27. Anti-Syphilis {**Lues-Rus-RL**} # (1-positive; 2-negative).

Results of screening in the reference-laboratory (Expert test-kits) - EIA

- 28. Anti-HIV {HIV-Murex-RL} # (1-positive; 2-negative)
- 29. Anti-HCV {HCV-Murex-RL} # (1-positive; 2-negative).
- 30. HbsAg {HBsAg-Murex-RL} # (1-positive; 2-negative)
- 31. Anti-Syphilis {Lues-Murex-RL} # (1-positive; 2-negative).

Results of screening in the Reference-laboratory (screening of 10% of negative results) – EIA

- 32. Anti-HIV {HIV-10-RL} # (1-positive; 2-negative)
- 33. Anti-HCV {HCV-10-RL} # (1-positive; 2-negative)
- 34. HBsAg {HBsAg-10-RL} # (1-positive; 2-negative)
- 35. Anti-Syphilis {Lues-10-RL} # (1-positive; 2-negative).

Results of screening in the reference-laboratory (screening of anti-HIV positive results): Immunoblot

- 36. Immunoblot HIV {HIV-Blott RL} # (1-positive; 2-negative)

Final results of screening in the Reference-laboratory – EIA

- 37. Anti-HIV {HIV-Final-RL} # (1-positive; 2-negative)
- 38. Anti-HCV {HCV-Final-RL} # (1-positive; 2-negative)
- 39. HBsAg {HBsAg-Final-RL} # (1-positive; 2-negative)
- 40. Anti-Syphilis {Lues-Final-RL} # (1-positive; 2-negative)

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For more information, please contact:

The Global HIV/AIDS Program

World Bank Group
1818 H St. NW
Washington, DC 20433

Tel: +1 202 458 4946

Fax: +1 202 522 1252

wbglobalHIVAIDS@worldbank.org

Europe and Central Asia Region

Human Development Unit
The World Bank
1818 H Street NW

Washington DC 20433

Tel: +1 202 473 0163

Fax: +1 202 477 0574