

# General awareness of HIV, tuberculosis co-infections and the quality of life among patients with HIV in Xinjiang, in western China



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***This thesis is for my father Mamatsabit  
who is in heaven, my mother Reihan,  
my husband Kaiser and my son Imran.***

## **ABSTRACT**

Mycobacterium tuberculosis (TB) and human immune deficiency virus (HIV) infections are major global health problems. The overall aims of my thesis were to analyze awareness of HIV, to examine the care of HIV and TB patients and to identify factors reducing their quality of life.

In **paper I**, questionnaires were distributed to 400 university students in 2004. Twenty open interviews were conducted. There were knowledge gaps about how HIV is not transmitted. Twenty-eight per cent of the undergraduates and 17% of the postgraduates would not tell anyone if they were infected with HIV. In the interviews students' knowledge of HIV/AIDS seemed to be superficial.

In **paper II**, a descriptive, cross-sectional survey of knowledge and attitudes about HIV among 291 consecutively selected pregnant women was conducted in November 2005 in Aksu city. We found limited knowledge of mother-to-child transmission, with several common misconceptions. The common belief that social contact causes transmission means there is a high risk that patients are stigmatized.

In **paper III**, clinical and laboratory data of 333 patients with HIV and TB were compared with 2668 patients with HIV only 2006-2011. The adherence to guidelines for isoniazid prophylactic treatment was low, in particular for patients who were intravenous drug users (IVDU) at 51.4% compared to 63.1% for non-IVDU ( $p < 0.05$ ) patients. The one-year cure rate of TB in our study was 69.2%, compared to 91.4% for all cases of TB in Xinjiang 2011. The risk of not surviving over five years was significantly higher in patients with HIV+TB compared to HIV only, after adjusting for sex and IVDU with HR=1.84 (95% CI 1.43-2.35;  $p < 0.0001$ ).

In **paper IV**, a total of 679 HIV-positive patients on antiretroviral treatment were recruited from four clinics in Urumqi 2013-2014. The patients from Xinjiang had a significantly lower health-related quality of life (HRQL) than patients from France, Australia, the US, Brazil, Thailand, Cambodia, Senegal and central southern China, when comparing treatment impact and general health scores. We found that 86% of the patients on antiretroviral treatment for HIV were afraid to tell others they were HIV positive, 70% reported economic difficulties, and 69% felt often or always depressed, but only one per cent received anti-depressive treatment.

**Conclusions:** Knowledge of HIV/AIDS among students and pregnant women was superficial and need improvement.

The low cure rate of TB and reduced 5-year survival in HIV-positive patients co-infected with TB could be caused by late diagnosis of HIV and no availability of TB-resistance tests, together with a lack of documented high levels of adherence to HIV and TB treatment regimens. Patients in Xinjiang had low HRQL compared to the central southern China and seven other countries.

**Key words:** HIV, tuberculosis, quality of life, prevention, pregnancy, isoniazid prophylaxis, treatment outcome.

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## **SUMMARY IN ENGLISH**

Mycobacterium tuberculosis (TB) and human immune deficiency virus (HIV) infections are major public health problems, particularly in low and middle-income countries. China has the second-highest number of TB cases per year in the world after India. The overall aims of my thesis were to analyze awareness of HIV and identify measures for its prevention in Xinjiang, northwestern China. They were also to examine the care of HIV and TB patients and to identify factors reducing their quality of life.

Much of the current spread of HIV in China has been through intravenous drug use and sex work. In 2013, 417,000 HIV positive persons were reported in China. From a study carried out between 2004 and 2013, the majority (86%) of people with HIV in China were between 20 and 50 years old. At the end of September 2014 the Center for Disease Control reported 43,533 HIV-positive people in Xinjiang. Injection drug use has been the main route of transmission for HIV in Xinjiang, causing 90% of all reported HIV infections. About two-thirds of drug users in Xinjiang are under the age of 35 – and engage in behaviors likely to spread HIV, such as sharing injection equipment and unprotected sex.

We distributed a questionnaire to 400 university students in Urumqi, Xinjiang in 2004 and 20 participated in open interviews, 95% of whom knew the most common routes of transmission. However, knowledge of HIV/AIDS among university students seemed to be superficial. There were knowledge gaps as to how HIV was, and was not, transmitted. Twenty-eight per cent of undergraduates and 17% of postgraduates would not tell anyone if they were infected with HIV. To increase knowledge of HIV can influence levels of disclosure and hence reduce risky behavior.

Most children living with HIV acquire the infection through mother-to-child transmission (MTCT), which can occur during pregnancy, delivery, or during the breastfeeding period. The risk of MTCT can be reduced to less than 2% by interventions that include antiretroviral prophylaxis treatment for HIV given to the mother during pregnancy and delivery and to the infant in the first weeks of life. This is combined with obstetrical interventions including elective caesarean delivery and complete avoidance of breastfeeding. If no safe replacement feeding is possible, antiretroviral treatment for the mother during the breastfeeding period should be continued. With these interventions, new HIV infections in children are becoming increasingly rare in many parts of the world.

In a 2005 study of 291 pregnant women in the city of Aksu, north-western China, we found a limited knowledge of mother-to child transmission and several misconceptions. The common belief that social contact causes transmission results in a high risk that patients will be stigmatized. Insufficient knowledge of HIV prevention reduces acceptance of HIV testing and the preventive program. Further campaigns in the media and additional efforts to raise the level of awareness among pregnant

women are essential.

Tuberculosis and HIV are fatally synergistic. In high-burden countries, people with HIV are 20 times more likely to contract TB, and reciprocally, TB bacteria can hasten the progression of an HIV infection, causing patients to become sicker more rapidly. TB is the leading infectious killer of people with HIV, especially in sub-Saharan Africa, where it causes up to half of all deaths. TB-HIV co-infections are also on the rise in other areas of the world, particularly western Asia, including China, and in eastern Europe. As long as HIV continues to spread, TB will remain a constant and deadly threat.

In our study 2006-2011 the prevalence of TB co-infection in the HIV positive patients in Xinjiang was 11%, which was significantly higher than the national figure in China of 2%. TB can effectively be prevented in patients with immune dysfunction by preventive treatment with the TB-drug isoniazid. Among patients fulfilling the criteria for such preventive therapy, only 57.9% received the prophylaxis.

Of the patients with HIV+TB, 72.7% were men compared to 55.3% for patients with HIV only. The main route of the HIV infection among patients with HIV+TB was IVDU, at 58.3%, which was significantly higher than for patients with HIV only, at 38.9%. In our study of HIV-positive patients the TB cure rate was 69.2%, and thus lower than the officially-reported 91.4% for all cases of TB in Xinjiang 2011. The risk of not surviving five years after diagnosis of HIV increased 1.84 times in patients with TB after adjustment for intravenous drug use and sex.

The health related quality of life was studied 2013-2014 on 679 patients on treatment for HIV in Urumqi, Xinjiang. They had a lower quality of life than patients in central southern China and seven other countries. As many as 86% of the patients were afraid to tell others they were HIV positive and 55% had fears of infecting others. The majority of the patients in our study worried about what family, friends and neighbors thought of them because of their HIV status. The fundamental challenges associated with living with HIV, such as stress, stigma, poverty and depression, have a negative impact on HRQL, and need to be reduced when managing patients. This should be done while providing access to high quality medical care, together with psychological and social support.

A major step in the right direction will have to include a more serious effort to reduce stigmatization and discrimination, as they have a negative impact on the quality of life of people living with HIV and AIDS, and encourage high-risk behavior.

To summarize, the discrimination of HIV-positive people should be reduced. Also, contact with healthcare services for HIV testing and treatment should be encouraged. Health clinics for the treatment of HIV and tuberculosis need to be available for all patients, including those in remote areas. These measures, along with community and family support, will improve quality of life and reduce mortality rates.

## SAMMANFATTNING PÅ SVENSKA

Tuberkulos och HIV är stora folkhälsoproblem främst i låg- och medelinkomstländer. Kina har näst flest fall av tuberkulos i världen efter Indien.

Huvudavsikten med min avhandling var att analysera medvetenheten om HIV, samt förebyggande åtgärder och behandling av HIV och tuberkulos i Xinjiang, nordvästra Kina och att identifiera orsaker till bristande livskvalitet bland personer som lever med HIV.

Stor del av aktuell spridning av HIV i Kina har varit via intravenöst drogmissbruk och sexarbete. 2013 rapporterades 437 000 HIV positiva i Kina. 86% av de HIV positiva i Kina var 20-50 år gamla i en studie 2004-2013. I slutet av September 2014 var det officiella antalet HIV positiva i Xinjiang 43 533, varav 90 % bedömdes vara orsakade av intravenöst missbruk. Av drogmissbrukarna i Xinjiang är 2/3 under 35 år, många har riskbeteende för spridning av HIV, såsom att dela nålar och oskyddad sex.

Vi delade 2004 ut frågeformulär till 400 universitetsstudenter i Urumqi, Xinjiang och 20 deltog i öppna intervjuer. 95 % av studenterna kände till de vanligaste smittvägarna för HIV, men det fanns kunskapsluckor om hur HIV inte sprids och vid intervjuer framkom att kunskapen ofta var ytlig. 28% av studenterna på grundutbildningsnivå och 17 % på avancerad nivå skulle inte berätta för någon om de var HIV positiva. Att öka kunskapsnivån om HIV kan påverka öppenhet och minska riskbeteende.

De flesta barn med HIV har fått infektionen från sina mödrar under graviditet, förlossning eller amning. Smittriskerna kan reduceras till under 2 % med åtgärder som innefattar HIV-läkemedel till mor under graviditet och förlossning och till barnet de första veckorna tillsammans med kejsarsnitt om läkemedelsbehandlingen inte lett till omätbara nivåer av HIV i kroppsvätskor hos modern vid förlossningen.

Mödrarna avråds från amning om säker flaskuppfödning är möjlig, om det inte är fallet ges behandling med HIV läkemedel till mödrarna under amningsperioden. Med dessa åtgärder har det blivit sällsynt med nya HIV infektioner hos barn på många håll i världen.

I en studie av 291 gravida kvinnor i Aksu, nordvästra Kina 2005, fann vi bristande kunskaper om HIV överföring från mor till barn med många missuppfattningar. Vanliga uppfattningar var att sociala kontakter kan sprida HIV, vilket ger hög risk för stigma. Otillräcklig kunskap om hur HIV skall förebyggas reducerar andelen som accepterar HIV test och det förebyggande programmet. Ytterligare kampanjer i media och andra åtgärder för att höja medvetenheten hos gravida är nödvändig.

Tuberkulos och HIV förstärker varandra på dödligt sätt. I länder med hög sjukdomsförekomst har personer med HIV 20 gånger högre risk att få tuberkulos och omvänt kan tuberkelbakterierna påskynda försämringen av HIV infektionen och leda

till tidigare sjukdomssymptom. Tuberkulos är en ledande orsak till död i infektion hos HIV positiva, särskilt i Afrika söder om Sahara, med upp till hälften av dödsfallen. Tuberkulos tillsammans med HIV blir allt vanligare i andra delar av världen, särskilt västra och centrala Asien inklusive Kina och östra Europa. Så länge HIV fortsätter att spridas, kommer också tuberkulos att kvarstå som ett dödligt hot.

I vår studie 2006-10 var förekomsten av tuberkulos hos HIV positiva patienter i Xinjiang 11 %, vilket är statistiskt säkerställt mer än den nationella siffran i Kina på 2 %. Tuberkulos kan effektivt förebyggas hos patienter med nedsatt immunfunktion med tuberkulosläkemedlet isoniazid. Bara 57,9 % av patienterna som uppfyllde kriterierna för sådan förebyggande behandling erhöll den.

Bland patienterna med samtidig HIV och tuberkulos var 72,7 % män, jämfört med 55,3 % för patienterna med enbart HIV. Den vanligaste smittvägen för HIV var intravenöst drogmissbruk hos patienterna med både HIV och tuberkulos på 58,3 % mot 38,9 % hos dem med bara HIV. Efter 1 år var bara 69,2% av tuberkulosinfektionerna botade hos patienterna med HIV, vilket är lägre än det officiella resultatet för alla med tuberkulos i Xinjiang 2011 på 91,4 %. Risken att inte överleva 5 år efter diagnos av HIV ökade 1,84 gånger hos patienter med samtidig tuberkulos efter korrigering för intravenöst missbruk och kön.

Den hälsorelaterade livskvaliteten undersöktes hos 679 patienter med HIV behandling i Urumqi 2013-14. Vi fann lägre nivå på livskvaliteten än i centrala och södra Kina samt 7 andra länder. Så många som 86 % var rädda för att berätta för andra att de var HIV positiva och 55 % var rädda för att smitta andra. Majoriteten av patienterna i vår studie var oroliga för vad familjen, vänner och grannar tänker om dem på grund av HIV. De fundamentala utmaningarna kopplade till att leva med HIV, såsom stress, stigma, fattigdom och depression har negativ effekt på livskvaliteten och behöver reduceras i handläggningen av patienterna. Det kan ske genom tillgång till medicinsk vård av hög kvalitet tillsammans med psykologiskt och socialt stöd.

Ett väsentligt steg i rätt riktning måste inkludera allvarigare ansträngningar att minska stigmatiseringen och diskrimineringen eftersom det har negativ effekt på livskvaliteten hos personer som lever med HIV/AIDS kan leda till ökat riskbeteende.

Summerat, måste diskrimineringen av HIV positive minska. Vidare behöver kontakten med hälsovården uppmuntras för HIV test och behandling. Kliniker som behandlar HIV och tuberkulos måste bli tillgängliga för alla patienter, också för dem i avlägsna områden. Dessa åtgärder tillsammans med stöd från samhälle och familj behövs för att öka livskvalitet och minska dödlighet.



## 概述

艾滋病和结核病是目前全球严重的公共卫生问题,两者互为影响,流行日趋严重,尤其是在低收入及中等收入国家。中国是全球第二个结核病高负担国家。该论文的总体目标是分析新疆艾滋病与结核病的意识及防治情况,确定降低 HIV 感染者生活质量的因素。

在中国,目前 HIV 主要是通过静脉吸毒和性传播。截至 2013 年底,中国报告了 437,000 例 HIV 感染者。据 2004 年-2013 年的研究发现,大多数(86%)感染者的年龄在 20-50 岁之间。截至 2014 年底,疾病预防控制中心报告新疆有 43,533 例 HIV 阳性患者。静脉吸毒是新疆最主要的 HIV 传播途径,有 90%的静脉吸毒者感染 HIV。与中国的其他地区一样,新疆 HIV 阳性者大多为年轻人,有三分之二吸毒者的年龄均在 35 岁以下,他们有传播 HIV 的危险行为,如共用注射器具和无保护的性行为。

2004 年在新疆乌鲁木齐某高校向大学生发放了 400 份问卷,并进行了 20 个开放式访谈。95%的学生知道最常见的传播途径,但在“如何不会传染艾滋病病毒”的相关知识上存在分歧,在访谈中发现,相关 HIV 的知识还很欠缺。28%的大学生和 17%的研究生表示如果感染了 HIV,不愿把这个信息告诉任何人。提高对艾滋病相关知识的了解,可以降低高危行为的发生。

儿童感染 HIV 的主要途径是母婴传播,可以发生在妊娠、分娩或哺乳过程中。通过给 HIV 阳性孕妇在孕期、分娩时和婴儿出生后一周用药,同时采取择期剖宫产和人工喂养,传播的风险可以降低到 2%。如果没有可替代的安全喂养品,在母乳喂养期间母亲应该继续抗病毒治疗。利用这些干预措施,在世界很多地区,儿童感染 HIV 的人数在逐步减少。

2005 年,在中国西北的阿克苏市,对 291 例孕妇进行了研究,发现在 HIV 母婴传播的相关知识中存在一些误区,类似“日常接触会传染 HIV 病毒”这样的误解,很可能引起对 HIV 感染者的歧视问题。HIV 预防知识的欠缺,降低了 HIV 病毒的检测和预防计划。通过媒体和相关工作上的努力,进一步提高孕妇的意识水平是必不可少的。

结核病与 HIV 病毒是一对致命的组合,两者会产生生物协同作用。在高负担的国家,感染 HIV 病毒者患结核病的可能性是非感染者的 20 倍。结核菌的感染加速了 AIDS 的进程,使患者病情迅速加重。结核病是艾滋病患者的首要杀手,尤其在撒哈拉以南非洲,结核病导致一半 HIV 感染者死亡。全球其他地区,HIV 和结核合并感染率也在上升,尤其在西亚(包括中国)和东欧。只要 HIV 的感染继续蔓延,结核病就仍然是一个致命的威胁。

在研究中发现,2006-2011 年新疆结核病合并 HIV 感染者的患病率为 11%,明显高于国内的数据(2%)。在抗逆转录病毒治疗的 HIV 感染者中,异烟肼预防性治疗可以降低患者发生结核病的风险,但在符合这个治疗标准的患者

中，只有 57.9%接受了预防性治疗。

在该研究中，男性患者在 HIV 感染合并结核的患者中占 72.2%，在单纯 HIV 感染者中占 55.3%；合并感染者中，HIV 感染的主要途径是静脉吸毒，占 58.3%，明显高于单纯 HIV 感染者（38.9%）；结核病的治愈率在合并感染者中占 69.2%，低于 2011 年新疆结核病疫情相关报告（91.4%）。HIV 合并结核患者中，由静脉吸毒和性传播而感染的患者 5 年存活率降低 1.84 倍。

2013-14 年，对 679 例在乌鲁木齐接受抗病毒治疗的患者进行了研究，HIV 感染者的生活质量较我国中南地区及其他七个国家低。86% 的患者害怕告诉别人自己感染了 HIV，55% 的患者担心会传染别人。大多数患者担心他们的家人、朋友和邻居会因为他们的感染状况而有所看法。HIV 感染者面临的问题最根本的是压力、歧视、贫困和抑郁，而这些对生活质量会产生负面影响，在对患者的管理中需要减少这些，同时提供高质量的医疗保健以及心理和社会的支持。最重要的是要减少羞辱和歧视，因为这对 HIV 感染者及艾滋病患者的生活质量有负面影响，并且能促使高危行为的发生。

总之，要减少对 HIV 感染者的歧视，医疗机构需要给 HIV 感染者提供检测、预防和治疗方面的支持，对所有 HIV 感染者和结核病患者（包括偏远地区的患者），提供预防与治疗措施，同时，随着给患者提供社区及家庭的支持来提高他们的生活质量，降低死亡率。

## قىسقىچە مەزمۇنى

ئەيدىز ۋە تۇبېركۇلىيۇز كېسەللىكى نۆۋەتتە دۇنيا بويىچە ئېغىر بولغان ئاممىۋىي سەھىيە مەسىلىسى بولۇپ، ئىككىسى ئۆز-ئارا تەسىرلىشىپ، تارقىلىش ۋەزىيىتى كۈنسېرى ئېغىرلاشماقتا، بولۇپمۇ ئوتتۇرا-تۆۋەن كىرىملىك ئەللەردە تېخىمۇ شۇنداق بولۇۋاتىدۇ. مەزكۇر ماقالىدە، شىنجاڭدىكى كىشىلەرنىڭ ئەيدىز ۋە تۇبېركۇلىيۇز كېسەللىكىگە بولغان تونۇشى ۋە بۇ كېسەللىكلەرنىڭ ئالدىنى ئېلىش خىزمىتى ئۈستىدە ئانالىز يۈرگۈزۈلۈپ، ئەيدىز يۇقۇمدارلىرىنىڭ تۇرمۇش سۈپىتىگە تەسىر كۆرسىتىۋاتقان ئامىللار ئايدىڭلاشتۇرۇلدى.

نۆۋەتتە، جۇڭگودا HIV ئاساسلىقى ۋېنا تومۇردىن زەھەر ئۆكۈل قىلىش ۋە جىنسىي ئالاقە ئارقىلىق تارقىلىدۇ. 2013-يىلىنىڭ ئاخىرىغىچە، جۇڭگو دوكلات قىلغان HIV يۇقۇمدارى 437 مىڭ نەپەر. 2004-يىلىدىن 2013-يىلىغىچە ئىشلەنگەن تەتقىقاتلاردىن مەلۇم بولۇشىچە، كۆپ ساندىكى (80%) يۇقۇملانغۇچىلارنىڭ ياش قورامىنىڭ 20-50 ياش ئارىلىقىدا ئىكەنلىكى مەلۇم بولغان. 2014-يىلىنىڭ ئاخىرىغىچە، كېسەللىكلەرنىڭ ئالدىنى ئېلىش-تىزگىنلەش مەركىزى دوكلات قىلغان شىنجاڭدىكى HIV يۇقۇمدارى 43 مىڭ 533 نەپەر، ۋېنادىن زەھەر چېكىش HIV نىڭ شىنجاڭدىكى ئاساسلىق تارقىلىش يولى بولۇپ، ۋېنادىن زەھەر چەككۈچىلەرنىڭ 90% ى HIV دىن يۇقۇملانغان. جۇڭگودىكى باشقا ئۆلكە-رايونلارغا ئوخشاشلا، شىنجاڭدىكى ئەيدىز يۇقۇمدارلىرىنىڭ كۆپچىلىكى ياشلار بولۇپ، ئۈچتىن ئىككى قىسىم زەھەر چەككۈچىلەرنىڭ يېشى 35 ياشتىن كىچىك، ئۇلاردا ئەيدىز ۋىرۇسىنى تارقىتىش خەۋپلىك قىلمىشى مەۋجۇت.

مەسلەن، شىپىرىسىنى ئورتاق ئىشلىتىش ۋە بىخەتەرلىك تەدبىرى قوللانمىغان ئەھۋال ئاستىدا جىنسىي ئالاقە قىلىشقا ئوخشاش.

2004-يىلى شىنجاڭ ئۈرۈمچىدىكى مەلۇم ئالىي مەكتەپ ئوقۇغۇچىلارغا 400 پارچە ئەھۋال ئىگىلەش قەغىزى تارقاتقان ھەمدە 20 قېتىملىق ئىختىيارىي سۆھبەت ئارقىلىق ئەھۋال ئىگىلىگەن. مەلۇم بولۇشىچە، %95 ئوقۇغۇچى ئەيدىزنىڭ كۆپ ئۇچرايدىغان تارقىلىش يوللىرىنى بىلىدىغان بولسىمۇ، ئەمما قانداق ئەھۋال ئاستىدا ئەيدىزنىڭ يۇقىمايدىغانلىقىغا ئائىت سوئالدا پەرقلەر كۆرۈلگەن. سۆھبەت ئارقىلىق ئوقۇغۇچىلارنىڭ ئەيدىزگە ئالاقىدار تونۇشىنىڭ بەكمۇ يېتەرسىزلىكى مەلۇم بولغان. %28 تولۇق كۇرس ئوقۇغۇچىسى ۋە %17 ماگېستىر ئاسپىرانت ئەگەر HIV دىن يۇقۇملىنىپ قالسا، بۇ ئەھۋالنى ھېچكىمگە ئېيتمايدىغانلىقىنى بىلدۈرگەن. ئەيدىزگە ئالاقىدار بىلىملەرگە بولغان تونۇشنى ئۆستۈرگەندە، خەۋپلىك قىلمىشلارنىڭ سادىر بولۇشىنى ئازلاتقىلى بولىدۇ.

بالىلارنىڭ HIV دىن يۇقۇملىنىش ئاساسلىق يولى ئانىدىن بالغا يۇقۇش بولۇپ، ھامىلىدارلىق مەزگىلى، تۇغۇش جەريانى ۋە ئېمىتىش مەزگىلىدە سادىر بولىدۇ. HIV دىن يۇقۇملىغان ھامىلىدار ئايال ھامىلىدارلىق مەزگىلى، تۇغۇش جەريانى ۋە بالا تۇغۇلغاندىن كېيىنكى 1 ھەپتىگىچە دورا ئىستېمال قىلغاندا، شۇنىڭ بىلەن بىرگە مەزگىل تاللاپ ئوپىراتسىيەلىك تۇغسا ھەمدە ئۆزى ئېمىتمەي سۈنئىي ئۇسۇللار بىلەن باقسا، ئانىدىن بالغا يۇقۇش خەتىرى %2 گە قەدەر تۆۋەنلەيدۇ. ئەگەر ئانا سۈتىنىڭ ئورنىنى ئالالايدىغان ھېچقانداق نەرسە بولمىغاندا، ئانا داۋاملىق ۋىرۇسقا قارشى داۋالاشنى قوبۇل قىلىشى كېرەك. بۇ خىل ئارىلىشىپ ئالدىنى ئېلىش تەدبىرلىرى ئارقىلىق دۇنيانىڭ ھەرقايسى جايلىرىدا بالىلارنىڭ HIV دىن يۇقۇملىنىش ئەھۋالى تەدرىجىي ئازلاۋاتىدۇ.

2005-يىلى، جۇڭگونىڭ غەربىي شىمالىدىكى شەھەر ئاقسۇدا، 291 نەپەر ھامىلىدار ئايال ئۈستىدىن تەتقىقات ئىشلەش ئارقىلىق، كىشىلەرنىڭ HIV نىڭ ئاندىن بالغا يۇقۇشىغا دائىر بىلىملەرگە بولغان چۈشەنچىلىرىدە «يۇقۇمدارلار بىلەن كۈندىلىك تۇرمۇشتا ئۇچرىشىش ئارقىلىقمۇ HIV يۇقىدۇ» دېگەنگە ئوخشاش بىر قىسىم خاتا قاراشلارنىڭ بارلىقى مەلۇم بولغان. بۇ بەلكىم يۇقۇمدارلارنى كەمىتىش مەسلىسىنى پەيدا قىلىشى مۇمكىن. HIV نىڭ ئالدىنى ئېلىش بىلىملىرىگە بولغان تونۇشنىڭ يېتەرسىز بولۇشى، HIV نىڭ تەكشۈرۈلۈش نىسبىتى ۋە ئالدىنى ئېلىش پىلانىنى كېمەيتىۋېتىدۇ. تاراتقۇلار خىزمىتى ۋە ئالاقىدار خىزمەتلەرنى تىرىشىپ ئىشلەش ئارقىلىق ھامىلىدار ئاياللارنىڭ تونۇشىنى يۇقىرى كۆتۈرۈش ئىنتايىن مۇھىم.

تۇبېركۇلىيۇز كېسەللىكى ۋە HIV ۋىرۇسى بولسا بىر جۈپ جانئالغۇچ گۇرۇپپا بولۇپ، ئىككىسى بىيولوگىيەلىك ماسلىشىش ھاسىل قىلالايدۇ. بۇ خىل كېسەللىكلەر يۇقۇم ئەھۋالى ئېغىر ئەللەردە، HIV دىن يۇقۇملانغۇچىنىڭ تۇبېركۇلىيۇز كېسەللىكىگە گىرىپتار بولۇش ئېھتىماللىقى يۇقۇملانمىغۇچىلارغا قارىغاندا 20 ھەسسە يۇقىرى بولىدۇ. تۇبېركۇلىيۇز باكتېرىيەسىدىن يۇقۇملىنىش ئەيدىز كېسەللىكىنىڭ تەرەققىياتىنى تېزلەشتۈرۈپ، بىمارنىڭ كېسەللىك ئەھۋالىنى جىددىي ئېغىرلاشتۇرۇۋېتىدۇ. تۇبېركۇلىيۇز بولسا ئەيدىز بىمارلىرىنىڭ بىرىنچى دەرىجىلىك قاتىلى، بولۇپمۇ سەھرايى كەبىرنىڭ جەنۇبىدىكى ئافرىقىدا تۇبېركۇلىيۇز كېسەللىكى ئەيدىز بىمارلىرىنىڭ پېرىمىنىڭ ئۆلۈپ كېتىشىنى كەلتۈرۈپ چىقارغان. باشقا جايلاردىمۇ بولۇپمۇ غەربىي ئاسىيا (جۇڭگونى ئۆز ئىچىگە ئالىدۇ)، شەرقىي ياۋرۇپالاردا تۇبېركۇلىيۇز بىلەن ئەيدىزدىن تەڭ يۇقۇملىنىش نىسبىتى ئېشىش يۈزلىنىشىدە بولۇۋاتىدۇ. HIV يۇقۇمى داۋاملىق تارقىلىدىكەن، تۇبېركۇلىيۇز

باشقىلارغا بىلدۈرۈشتىن قورققان ، %55 ى باشقىلارغا يۇقتۇرۇپ قويۇشتىن ئەندىشە قىلغان . كۆپىنچە بىمارلار ئاتا-ئانا ، ئۇرۇق-تۇغقانلىرى ، دوست-يارانلىرىنىڭ ئۆزىنىڭ يۇقۇملىنىش ئەھۋالىغا قارىتا باشقىچە نەزەردە بولۇشىدىن ئەنسىرەيدىكەن . ئەيدىز يۇقۇمدارلىرى دۇچ كېلىۋاتقان ئاساسىي مەسىلە بېسىم ، كەمىستىش ، نامراتلىق ۋە قايغۇ-ھەسرەت بولۇپ ، بۇلار بىمارلارنىڭ تۇرمۇشىغا ناچار تەسىر كۆرسىتىدۇ . يۇقۇمدارلارنى باشقۇرۇشتا بۇ ئامىللارنى ئازايتىش بىلەن بىرگە ، تېببىي ساقلىقنى ساقلاش ۋە پىسخىكىلىق ، ئىجتىمائىي قوللاش سۈپىتى يۇقىرى كۆتۈرۈش لازىم . ئەڭ مۇھىمى ، ھاقارەتلەش ۋە كەمىستىشنى كېمەيتىش كېرەك . چۈنكى بۇ ، يۇقۇمدارلارنىڭ تۇرمۇش سۈپىتىگە ناچار تەسىر كۆرسىتىدۇ ، شۇنداقلا ئۇلارنىڭ خەتەرلىك قىلمىشلارنى سادىر قىلىشىنى ئىلگىرى سۈرىدۇ .

ئومۇمەن ، HIV يۇقۇمدارلىرىغا بولغان كەمىستىشنى ئازايتىش ، داۋالاش ئورگانلىرى يۇقۇمدارلارغا تەكشۈرۈش ، ئالدىنى ئېلىش ۋە داۋالاش مۇلازىمىتى تەمىنلەپ ، بارلىق HIV يۇقۇمدارلىرى ۋە تۈبېركۇلىوز كېسەللىكى بىمارلىرى (چەت-ياقا رايونلاردىكى بىمارلارنىمۇ ئۆز ئىچىگە ئالىدۇ) غا ئالدىنى ئېلىش ۋە داۋالاش چارە-تەدبىرلىرىنى تەمىنلەش بىلەن بىر ۋاقىتتا ، بىمارغا بولغان ئىجتىمائىي ۋە ئائىلىۋى قوللاشنى يۇقىرى كۆتۈرۈش ئارقىلىق ئۇلارنىڭ تۇرمۇش سۈپىتىنى ئاشۇرۇپ ، ئۆلۈپ كېتىش نىسبىتىنى تۆۋەنلىتىش لازىم .

## **LIST OF PAPERS**

**I.** Elin Lönn, Karin Sahlholm, Rena Maimaiti, Kaisaier Abdulkarim, Rune Andersson  
A traditional society in change encounters HIV/AIDS: knowledge, attitudes, and risk  
behavior among students in northwestern China.

AIDS patient care and STDs 2007;21(1): 48 - 56

**II.** Rena Maimaiti and Rune Andersson

Awareness and attitudes about HIV among pregnant women in Aksu, Northwest  
China

Open AIDS Journal 2008; 2: 72–77.

**III.** Rena Maimaiti, Zhang Yuexin, Pan Kejun, Peierdun Mijiti, Maimaiti Wubili,  
Maimaitijiang Musa, Rune Andersson

High prevalence and low cure rate of tuberculosis among patients with HIV in  
Xinjiang, China

(submitted)

**IV.** Rena Maimaiti, Zhang Yuexin, Pan Kejun, Maimaiti Wubili, Lalanne, C,  
Duracinsky, M, Rune Andersson

Low quality of life among people living with HIV in Xinjiang, China

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## **LIST OF ABBREVIATIONS**

<b>AIDS</b>	<b>Acquired immuno-deficiency syndrome</b>
<b>ART</b>	<b>Antiretroviral therapy</b>
<b>ARV</b>	<b>Antiretroviral medications</b>
<b>AZT</b>	<b>Zidovudine</b>
<b>BCG</b>	<b>Bacillus Calmette-Guerin</b>
<b>CARES</b>	<b>Comprehensive AIDS response program</b>
<b>CCR5</b>	<b>CC chemokine receptor 5</b>
<b>CDC</b>	<b>Centre of Disease Control and Prevention</b>
<b>CFA</b>	<b>Confirmatory factor analysis</b>
<b>CFI</b>	<b>Comparative fit index</b>
<b>CI</b>	<b>Confidence interval</b>
<b>COG</b>	<b>Health concerns and mental distress</b>
<b>DST</b>	<b>Drug susceptibility testing</b>
<b>ED</b>	<b>Emotional distress</b>
<b>EFV</b>	<b>Efavirenz</b>
<b>ELISA</b>	<b>Enzyme-linked immunosorbent assay</b>
<b>EPTB</b>	<b>Extrapulmonary tuberculosis</b>
<b>FI</b>	<b>Fusion inhibitor</b>
<b>FSW</b>	<b>Female sex workers</b>
<b>HC</b>	<b>Health concerns</b>
<b>HIV</b>	<b>Human immunodeficiency virus</b>
<b>HRQL</b>	<b>Health related quality of life</b>
<b>HSV</b>	<b>Herpes simplex virus</b>
<b>IPT</b>	<b>Isoniazid preventive therapy</b>
<b>INSTI</b>	<b>Integrase strand transfer inhibitor</b>
<b>IRIS</b>	<b>Immune reconstitution inflammatory syndrome</b>
<b>IVDU</b>	<b>Intravenous Drug Use</b>
<b>LPV/r</b>	<b>Lopinavir/ritonavir</b>
<b>MDR-TB</b>	<b>Multidrug-resistant tuberculosis</b>
<b>MIMIC</b>	<b>Multiple indicator multiple cause</b>
<b>MSM</b>	<b>Men who have Sex with Men</b>
<b>MTCT</b>	<b>Mother-to-child transmission</b>
<b>NAAT</b>	<b>Nucleic acid amplification test</b>
<b>NRTI</b>	<b>Nucleos(t)ide reverse transcriptase inhibitors</b>
<b>NNRTI</b>	<b>Non-nucleoside reverse transcriptase inhibitor</b>
<b>NVP</b>	<b>Nevirapine</b>
<b>PHS</b>	<b>Physical health and symptoms</b>
<b>PCR</b>	<b>Polymerase chain reaction</b>
<b>PI</b>	<b>Protease inhibitors</b>
<b>PLHIV</b>	<b>People Living with HIV</b>
<b>PMTCT</b>	<b>Prevention of mother-to-child transmission</b>
<b>PPD</b>	<b>Purified protein derivative of tuberculin</b>

<b>PROQOL-HIV</b>	<b>Patient-reported outcome quality of life - HIV</b>
<b>PTB</b>	<b>Pulmonary tuberculosis</b>
<b>REL</b>	<b>Social and intimate relationships</b>
<b>St</b>	<b>Stigma</b>
<b>STD</b>	<b>Sexually transmitted disease</b>
<b>STI</b>	<b>Sexually transmitted infections</b>
<b>TB</b>	<b>Tuberculosis</b>
<b>TRT</b>	<b>Treatment-related impact</b>
<b>TDF</b>	<b>Tenofovir</b>
<b>UNAIDS</b>	<b>The Joint United Nations Program on HIV/AIDS</b>
<b>WHO</b>	<b>World Health Organization</b>
<b>XDR TB</b>	<b>Extensively drug-resistant tuberculosis</b>
<b>3TC</b>	<b>Lamivudine</b>

# 1. INTRODUCTION

## 1.1 HIV/AIDS

AIDS is the abbreviation for Acquired Immune Deficiency Syndrome, and is an immunodeficiency disease caused by the human immunodeficiency virus (HIV). AIDS was first reported in 1981 in the United States among men who had sex with men. HIV quickly spread around the world and continues to be a major global public health issue<sup>[1]</sup>.

### 1.1.1 Transmission of HIV

The most common route of HIV transmission globally is unprotected heterosexual intercourse. HIV is more easily transmitted to persons with other concomitant sexually transmitted diseases (STDs).

Other routes of HIV transmission are by infected blood or blood products, vertical transmission from mother to child, and by use of infected needles or occupational needle stick injuries<sup>[2]</sup>. There is also a spread among intravenous drug abusers and between men who have sex with men<sup>[3]</sup>. The transmission depends on the properties of the virus and the host. The viral characteristics affect the spread of the virus, including viral biological characteristics, the number of virus particles in the body fluids and the amount of fluid transferred<sup>[4]</sup>. HIV has two distinct types, HIV-1 and HIV-2, which differ by almost 50% in nucleotide variation<sup>[5]</sup>. While HIV-1 is distributed all over the world and contributes to about 95% of all infections, HIV-2 has a lower rate of transmission and is predominately found in West Africa<sup>[6, 7, 8]</sup>.

### 1.1.2 Diagnosis of HIV

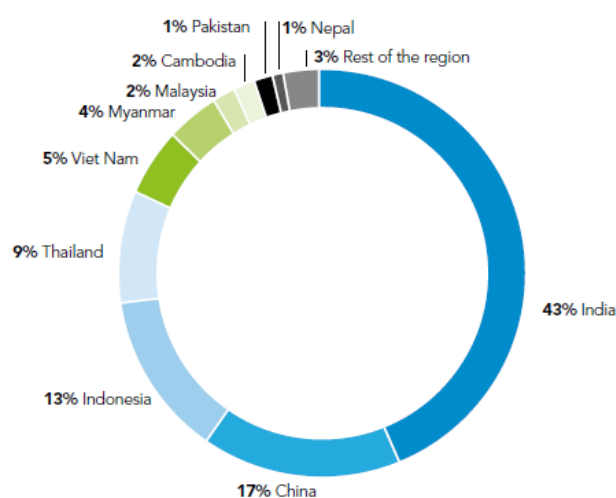
Highly sensitive and specific HIV screening is helpful in reducing the transmission of the disease from blood transfusions<sup>[9]</sup>. The detection of HIV infection includes tests for antibodies, antigens and RNA. HIV-specific antibody testing is the most common approach. However, the time from infection to the production of antibodies, the “window period”, ranges from two to four weeks, depending on the generation of the test kit<sup>[10, 11]</sup>. The most commonly used testing algorithm, the “conventional algorithm”, employs two enzyme-linked immunosorbent assay (ELISA) tests and discordant samples resolved with Western Blot. But Western Blot is costly and requires technical expertise. The WHO recommends that the first test should have high sensitivity and the second test needs to have a high specificity. Simple/rapid tests have high sensitivity and specificity, similar to ELISA based assays<sup>[12]</sup>. Other methods for detecting HIV include the detection of p24 antigen and viral nucleic acid by the nucleic acid amplification test (NAAT). The NAAT include detection of viral RNA or DNA by polymerase chain reaction (PCR).

### 1.1.3 HIV Epidemiology

#### 1.1.3.1 HIV epidemic in the world

There were an estimated 35 (33.2–37.2) million people globally living with HIV in 2013. That year, 2.1 million people (1.9-2.4) became newly infected with HIV, and 1.5 million (1.4-1.7) died from AIDS-related illnesses<sup>[1]</sup>. Fifteen countries including China accounted for more than 75% of the 2.1 million new HIV infections that occurred in 2013<sup>[1]</sup>.

People living with HIV in Asia and the Pacific, 2013



Source: UNAIDS 2013 estimates.

**Figure 1. County distribution of 4.8 million HIV positive cases in Asia and the Pacific 2013 according to UNAIDS<sup>[1]</sup> ( adapted from UNAIDS Gap report)**

After sub-Saharan Africa, the region with the second largest number of people living with HIV is Asia and the Pacific, with an estimated 4.8 million (4.1 million–5.5 million) HIV-positive people at the end of 2013<sup>[1]</sup>. For details, see Figure 1. The number of new HIV infections in south and south-east Asia declined by 8% and AIDS-related deaths fell by 37% between 2005 and 2013<sup>[1]</sup>. There are an estimated 3.8 million people who inject drugs in Asia and the Pacific<sup>[1]</sup>. The majority of HIV infections among women in Asia occur among the long-term sexual partners of the clients of sex workers or intravenous drug users.

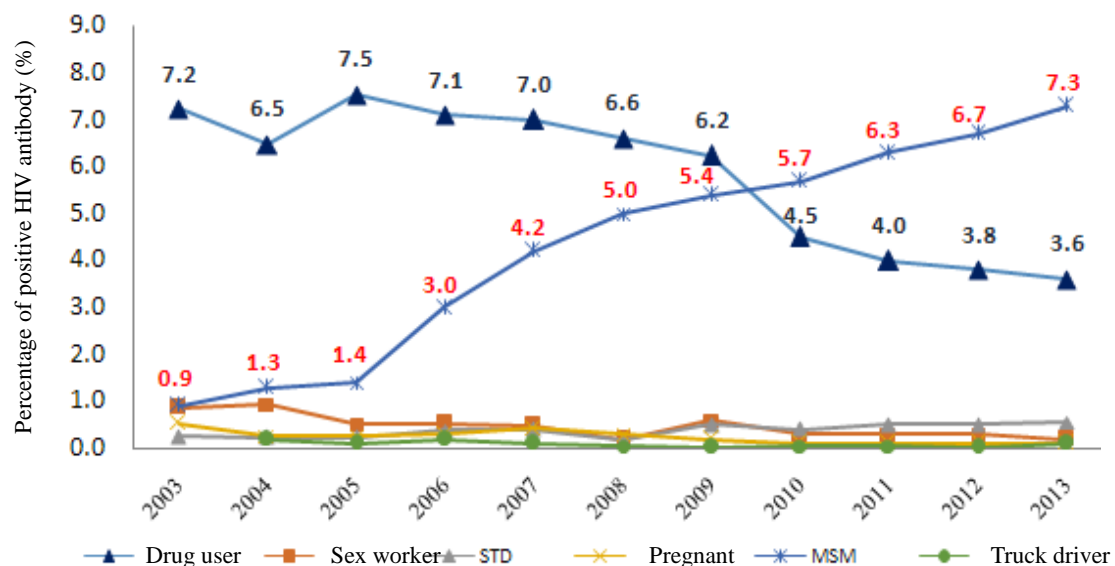
#### 1.1.3.2 HIV epidemic in China

In China wide geographic variations exist with respect to the HIV epidemic<sup>[13]</sup>. The HIV spread is mostly related to intravenous drug use and sex work in south and north-west China and to plasma donation in central China<sup>[14,15]</sup>. Around the country, 96.1% of counties (districts) (2981/3101) in 31 provinces (autonomous regions and

municipalities) have reported cases of HIV. By the end of 2013, the number of people living with HIV accounted for 0.033% of China's total population. Although there are still some undiagnosed cases of HIV, the national HIV epidemic overall maintains a low prevalence<sup>[16]</sup>.

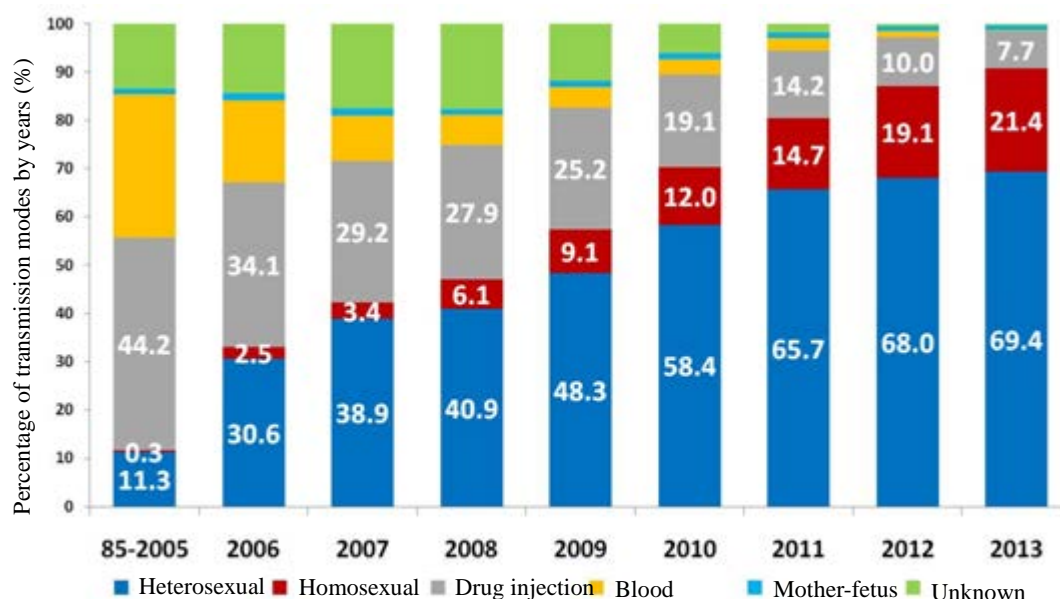
From 2004 to 2013, 221,314 cases of HIV were reported and 63,524 AIDS-related deaths occurred in China. The prevalence of HIV has grown steadily in this period, from 0.28 cases per 100,000 persons in 2004 to 3.06 cases per 100,000 persons in 2013. The majority (86%) of HIV positive cases are people aged between 20 and 50, with the highest proportion, 32% of cases, in the age group 30 to 39 and the lowest proportion among children between 0 and 9 years old (1%)<sup>[16]</sup>.

By the end of 2013, there were a reported 437,000 people living with HIV/AIDS (including 263,000 people living with HIV and 174,000 AIDS patients). Sexual transmission between men having sex with men has increased rapidly over the last years, but IVDU has decreased in this period.<sup>[17]</sup> (Figure 2).



**Figure 2: Changing trends of HIV-Positive prevalence among different groups from AIDS Sentinel Surveillance Data in China, 2003-2013<sup>[17]</sup> (adapted from 2014 China AIDS Response Progress Report)**

Of the cases reported over the years, the numbers of both male homosexual and heterosexual transmissions show a consistent upward trend. Of new cases diagnosed each year, the proportion of sexually transmitted cases increased from 33.1% in 2006 to 90.8% in 2013, with the proportion of male homosexuals increasing from 2.5% in 2006 to 21.4% in 2013<sup>[17]</sup> (Figure 3).



**Figure 3 Routes of transmission in newly diagnosed cases of HIV in China by year<sup>[17]</sup> (adapted from 2014 China AIDS Response Progress Report)**

Among Chinese female sex workers (FSW) in 2009 a prevalence of 28% had both chlamydia and gonorrhea co-infections, 17.3% only chlamydia, 5.9% only gonorrhea, 0.26% HIV and 6.5% syphilis<sup>[18,19]</sup>.

Among FSW in China a rapid increase of sexually transmitted infections (STI) has been reported in recent decades<sup>[20]</sup>. A study in 2006<sup>[18,21,22]</sup> revealed that the prevalence of STI co-infections was relatively high with between 23.9 and 48.3% of FSW infected with two co-infections and between 8.4 and 15.2% infected with three. The FSWs with an HIV infection were 5.3 (95% CI 1.2- 23.3) times more likely to be infected with syphilis<sup>[23,24]</sup>. The FSW with HSV-2 infection were more than two times as likely to be infected with HIV, and vice versa<sup>[21,25]</sup>. The FSW with trichomoniasis were about four times as likely to be infected with HIV<sup>[25]</sup>.

### 1.1.3.3 HIV in Xinjiang

AIDS was first recognized in China in 1985, but the first HIV-positive case was discovered in Xinjiang Uighur Autonomous Region in northwestern China in 1995<sup>[26-28]</sup>. The HIV incidence was 1.0-2.0/100,000 in 2008, 2.0-5.0/100,000 in 2009, but >5.0/100,000 since 2010 in Xinjiang<sup>[16]</sup>. A national HIV molecular epidemiology survey conducted in 1996 indicated that HIV infection in Xinjiang was a recent epidemic affecting local IDUs<sup>[28]</sup>. By the end of 2002, Xinjiang had the second highest number of reported cases of HIV in China after Yunnan<sup>[27]</sup>, and had the highest number of HIV cases per capita in the country<sup>[27]</sup>.

According to the local Centre for Disease Control 16,035 HIV positive patients were reported in Xinjiang at the end of June 2006, a rise of 4,732 in just nine months<sup>[29]</sup>, This could be due to the fact that in October 2005 the screening started of prisoners, intravenous drug users, blood donors, sex workers and pregnant women. The number of people living with HIV in Xinjiang is according to the official estimates around 43,533 at the end of September 2014<sup>[30]</sup>.

As is common elsewhere in China, most HIV- positive patients are young - about two-thirds of drug users in Xinjiang are under the age of 35 years - and engage in behaviors likely to spread HIV, such as sharing injection equipment and unprotected sex.

Injection drug use has been the main route of transmission for HIV in Xinjiang, causing 90% of all reported HIV infections<sup>[27]</sup>. In late 2004, the number of registered drug users reached 25,664, with some 15,400 taking drugs at that time. Given that the actual population of drug users is reportedly four to seven times the number of registered users, the total population of drug users may be as high as 180,000<sup>[29]</sup>.

A surveillance survey among drug users in Xinjiang's four prefectures reported that only 19.2% of drug users had used a condom with their sexual partners in recent sexual contact, and 25.5% had used a condom only occasionally in the previous six months<sup>[31]</sup>.

Xinjiang borders eight other countries including Afghanistan, Pakistan and the newly independent Central Asian countries some of which are well known poppy growing areas and sources of drugs.

#### **1.1.4 Treatment and Prevention**

Although the incidence of HIV is falling in most countries, new HIV infections continue to occur<sup>[32]</sup>. If not treated, the majority of people infected with HIV will eventually develop an immunodeficiency by CD4 T lymphocyte (CD4) cell depletion, leading to AIDS and premature death. The main purpose of the treatment is to prevent HIV / AIDS- related mortality and morbidity.

The lower reference level for CD4 count is 500 cells/mm<sup>3</sup><sup>[33]</sup> in HIV-negative persons. In HIV-positive individuals, CD4 cell count continues to decrease and most opportunistic diseases occur when it falls below 200 cells/mm<sup>3</sup>.

There is no cure for HIV infection, but effective treatment with antiretroviral drugs can control the virus so that people with HIV can enjoy healthy and productive lives<sup>[34]</sup>. There were 13.6 million people receiving antiretroviral therapy globally in June 2014<sup>[35]</sup>. The percentage of people living with HIV receiving antiretroviral

therapy has increased from 10 % in 2006 to 37 % in 2013.

Modelling studies suggest that expanded use of ART may result in a lower incidence of HIV on a community or population level<sup>[36]</sup>.

According to the 2013 WHO guidelines, the following groups were recommended to receive ART<sup>[37]</sup>: adolescents and adults with CD4 count  $\leq 500$  cells/mm<sup>3</sup>; patients with co-infection with TB or chronic hepatitis B; patients with seronegative partner; all HIV-positive pregnant and breastfeeding women and children younger than five. Also the patients with chronic hepatitis C have bad prognosis if not receiving ART, but it is not yet included in WHO guidelines. It is important with high adherence to the combination therapy to inhibit the replication and prevent the selection of resistant strains<sup>[38, 39]</sup>. Interruption of treatment can lead to viral replication and the deterioration of the immune function. Viral load testing is important for early detection of treatment failure in individuals receiving ART, complementing clinical and immunological monitoring<sup>[37]</sup>.

By the end of 2012, there were over 126,400 people receiving antiretroviral medications (ARV) through China's national policy. This included the Comprehensive AIDS Response Program (CARES), the "Four Frees and One Care"<sup>[40]</sup>. The "Four Frees" include free ARV, free HIV counseling and screening, free intervention for the prevention of mother to child transmission, and free education for AIDS orphans. "One Care" covers financial assistance to families living with HIV. Treatment follows Chinese treatment guidelines<sup>[41]</sup>.

However, challenges remain. Although the HIV prevalence rate in China is low, the study of 31,070 patients from 2002 to 2008 indicated that treatment failed for 25% of Chinese HIV patients, with the cumulative treatment failure rate increasing to 50% at five years<sup>[42]</sup>. Access to viral load monitoring and second-line treatment options are limited in China. There are gaps in the services offered by the Chinese "Four Free and One Care" program. Depressive symptoms, such as lack of pleasure in life, helplessness, and recurrent thoughts of suicide, interfered with daily life and the self-management of necessary medicines<sup>[43, 44]</sup>. It is noteworthy that the China CARES program does not include treatment for conditions associated with HIV and mental health problems. Depression has been associated consistently with treatment non-adherence<sup>[45]</sup>.

A total of 30 antiretroviral medications including nucleos(t)ide reverse transcriptase inhibitors (NRTI), non-nucleoside reverse transcriptase inhibitor (NNRTI), protease inhibitors (PI), fusion inhibitor (FI), integrase strand transfer inhibitor (INSTI) and CC chemokine receptor 5 (CCR5) antagonist<sup>[46]</sup>. Only 8 drugs are available in Xinjiang: zidovudine, tenofovir, stavudine, lamivudine, efavirenz, nevirapine, lopinavir/ritonavir. According to Chinese treatment guidelines, the first-line drugs are: Tenofovir (TDF) or zidovudine (AZT) + lamivudine (3TC) + efavirenz (EFV) or



nevirapine (NVP). Second line drugs are: TDF+3TC+ lopinavir/ritonavir (LPV/r)<sup>[41]</sup>.

### **1.1.5 Mother to child transmission of HIV**

The transmission of HIV from an HIV-positive mother to her child during pregnancy, delivery or breastfeeding is called mother-to-child transmission (MTCT). It is one of the important routes of transmission . The risk of infection from HIV-positive mother to child was before the preventive programs 15% to 25% in high income countries and 25% to 35% in low and middle income countries<sup>[47]</sup>.

Mother-to-child transmission of HIV is largely preventable with the right interventions. If combination ART is initiated before 28 weeks' gestation and an HIV RNA level <50 copies/mL is obtained near delivery, the rate of perinatal transmission can be reduced to between 0.1% and 0.5%<sup>[48, 49]</sup>. Thus, the use of combination ART drug regimens is recommended for all HIV-positive pregnant women. Following delivery, in the absence of breastfeeding, considerations regarding continuation of the ART for maternal therapeutic indications are the same as those regarding ART for other non-pregnant individuals<sup>[50]</sup>. In European countries the infection rate is less than 2% after preventive programs<sup>[51]</sup>. One study from Kenya shown the highest prevalence of HIV-1 DNA in breast milk cells in samples collected between 1 week and 3 months<sup>[52]</sup>. Most breast milk transmission occurred early<sup>[53]</sup>. Elective caesarean delivery before rupture of the membranes reduces the transmission risk by approximately half<sup>[54,55]</sup>.

Three- quarters of pregnant women, known to be HIV-positive, received antiretroviral therapy to prevent mother-to-child transmission in 2011<sup>[56]</sup>. When accessible and implemented optimally, ART for the prevention of mother-to-child transmission (PMTCT) represents one of the greatest achievements to date in HIV prevention, with the potential to eliminate vertical HIV transmission<sup>[57]</sup>. In low- and middle-income countries where PMTCT services have been scaled up, more than 620,000 new HIV infections among infants were averted between 2001 and 2012<sup>[32]</sup>.

Each aspect of the preventive program is important, and a deficiency in any of the interventions compromises overall effectiveness, thereby resulting in increased risk for MTCT<sup>[58,59]</sup>. It is likely that newly-diagnosed women represent a vulnerable group who are yet to come to terms with their HIV-positive diagnosis and need to overcome barriers such as stigma and lack of disclosure<sup>[60]</sup>. Health systems should aim not only to provide knowledge to these women but also to cultivate a supportive relationship that enables the women to apply their newly-acquired knowledge to their daily lives, and come up with ways of implementing healthy daily routines<sup>[61,62]</sup>.

In China, 7 % of babies born to HIV-positive mothers in 2011 were infected with HIV<sup>[63]</sup> and 1.1% of all HIV positive patients in 2011 were infected through mother-to-child transmission<sup>[63]</sup>. The proportion of pregnant women in China tested

for HIV increased from 64 % in 2010, to 92 % in 2011<sup>[63,64]</sup>.

### **1.1.6 Awareness and Attitudes of HIV/AIDS**

Insufficient knowledge of HIV prevention increases the risk of getting HIV<sup>[65]</sup>. Too few qualified teachers in HIV education (especially in rural areas) and the lack of appropriate teaching materials on HIV prevention in minority languages may be hindering educational efforts. However, in 2011, reports indicated that basic HIV knowledge was high among young students in China<sup>[63]</sup>. Young people are the most active group in society and they can play a leading role in the prevention of HIV. Their ideas, attitudes and behaviors play a major role here. In many parts of the world, young people have particularly high levels of risk behavior with unprotected heterosexual intercourses, unprotected sex between men and IVDU. Young people are also often especially vulnerable to exploitation that may increase their susceptibility to infection<sup>[66]</sup>.

## **1.2 Tuberculosis**

### **1.2.1 Cause and Transmission of tuberculosis**

Tuberculosis is caused by pathogenic bacteria known as *Mycobacterium tuberculosis*. The bacterium is an aerobic rod-shaped bacillus that is spread through coughing or sneezing. As few as 10 bacilli are enough to cause infection<sup>[67]</sup>. After exposure to *M.tuberculosis*, only 30% of people will be develop clinical disease<sup>[68, 69]</sup>. The bacteria mainly affect the lungs, resulting in pulmonary TB (PTB). Latent infection is usually asymptomatic, but remains as a reservoir for potential transmission to close contacts after reactivation. The bacteria enter the blood stream and invade other organs resulting in extra-pulmonary TB (EPTB). The most common areas of spread include lymph nodes, pleura, pericardium, peritoneum, kidneys, spine, meninges, brain and bone.

### **1.2.2 Epidemiology**

#### **1.2.2.1 Tuberculosis in the world**

Tuberculosis (TB) is an ancient disease, documented as early as 6000 BC. In 2013, an estimated 9.0 million people developed TB and 1.5 million died from the disease. Of these, about 1.2 million (14%) had a HIV co-infection<sup>[70]</sup>. The burden of TB is highest in Asia and Africa. In 2013, more than half (56%) of all TB cases were in south-east Asia and the western Pacific regions. India and China alone accounted for 24% and 11% respectively. The African continent has 24% of the world's cases, and the highest rates of cases and deaths per capita.

HIV infection, malnutrition, immunosuppressive diseases and treatments, tobacco use, alcoholism and old age are among the factors that predispose latently infected individuals to develop the active disease<sup>[71,72]</sup>. Poverty has also contributed to the rise in TB cases especially in the 22 high-burdened TB countries. Poor housing, food insecurity and lack of access to health care has contributed to this<sup>[73]</sup>.

### **1.2.2.2 Epidemiology of tuberculosis in China**

According to WHO estimates, approximately one million new TB cases and 54,200 MDR-TB cases occurred in China in 2013<sup>[74]</sup>. In 2007 and 2008, China conducted a nationwide drug-resistance survey, and the results showed that the proportion of multi-drug resistant (MDR)-TB in smear-positive pulmonary TB patients was 8.3%. Of these, the proportion of MDR-TB was 5.7% in new patients and 25.6% in re-treated patients<sup>[74]</sup>.

### **1.2.2.3 Epidemiology of tuberculosis in Xinjiang**

Xinjiang has the second highest incidence of TB among all the provinces and autonomous regions in China. The incidence of TB in Xinjiang was estimated at 463 cases per 100,000 persons per year between 2001 and 2010<sup>[75]</sup>. Information on the prevalence of MDR and XDR TB remain scant in the region, as TB drug susceptibility testing (DST) has not been implemented as a routine test at any local hospitals. However, it was performed in combination with a clinical study in Urumqi from 2009 to 2011 and in that study the prevalence of MDR TB was 13.2 %<sup>[76]</sup>.

### **1.2.3 Diagnosis of tuberculosis**

The lack of rapid and reliable diagnostic methods is one of the main challenges facing TB control. Sputum microscopy has an advantage in that it is rapid, relatively cheap and highly specific<sup>[77]</sup>.

Compared with cultures in non-HIV infected persons, sputum microscopy has low sensitivity that ranges from 40% to 60%, and it has a much lower sensitivity in HIV-infected patients<sup>[78-85]</sup>. The gold standard for TB diagnosis is isolation and growth of *M. Tuberculosis* on the conventional culture media, but this takes about two months. Such late diagnosis is associated with the risk of increased transmission or even death from the disease. The liquid culture systems reduced the time from months to weeks. It was expected that Polymerase chain reaction (PCR) technique would improve TB diagnosis<sup>[78]</sup>. the WHO recommended the use of PCR as a diagnostic test as Gene Xpert MTB/RIF to detect *M. Tuberculosis* and rifampicin resistance among individuals suspected of having MDR-TB, or HIV-associated TB<sup>[86]</sup>. This test is useful but its relatively high cost, need for a continuous uninterrupted power supply and low sensitivity in the diagnosis of pediatric cases reduces its usefulness<sup>[87]</sup>.

Not all TB patients have coughs with expectorate, which poses difficulties in obtaining sputum samples for smear or culture. Similarly, it is often not possible to take sputum samples from children.

Urine is relatively easy to collect and less likely to cause infection than sputum collection. Lipoarabinomannan (LAM) is heat-stable and specific for the genus *Mycobacterium*<sup>[88-90]</sup>. Talbot and co-authors found that urine LAM was almost twice as sensitive as AFB sputum smear microscopy for the rapid diagnosis of tuberculosis<sup>[91]</sup>. Higher levels of LAM in urine was reported among hospitalized individuals with low median CD4 cell counts and more advanced HIV disease from several studies<sup>[91,92,93]</sup>. A study from Uganda supports the value of urine LAM testing combined with AFB sputum smear microscopy for early initiation of treatment in patients with CD4 counts < 200<sup>[94]</sup>, study from Ethiopia has shown that in patients with CD4 counts ≤100 cells/mm<sup>3</sup>, the combined sensitivity of urinary LAM detection and sputum smear microscopy was 66.7%<sup>[95]</sup>. A study from Tanzania by Inge Kroidl et al showed that MTB LAM ELISA tests had a high risk of contamination from dust, soil and also stool, especially among women during the dry season<sup>[96]</sup>. The dry environment in Xinjiang may also create a high risk of contamination. However, LAM testing is not carried out in our district.

Other tests to aid in the diagnosis of TB include radiological investigations that include chest radiography or CT-scans of the infected area.

#### **1.2.4 Prevention**

Preventive vaccine is one of the most useful ways to control infections The bacillus Calmette-Guerin (BCG) vaccine was first used on humans in 1921. It is effective in preventing prevent post-primary TB infections in children, such as meningitis and osteomyelitis, but largely ineffective in preventing TB in adults<sup>[97]</sup>. WHO recommends isoniazid preventive treatment (IPT) to HIV-positive people and TB-infection control and ART as the focus of prevention strategies<sup>[98, 99]</sup>. Studies have shown that IPT can reduce the risk of TB by up to 60%. IPT is recommended if there is a documented latent TB infection or exposure to infectious TB cases<sup>[99,100]</sup>.

### **1.3 HIV and Tuberculosis**

HIV and TB are the top two infectious agents causing death worldwide<sup>[101]</sup>. TB is the most common opportunistic infection in HIV-positive individuals<sup>[102]</sup>. Globally, 14.8% of TB patients have a HIV co-infection, and as many as 50% to 80% in parts of sub-Saharan Africa. TB screening among HIV-positive individuals has improved; a report from 64 countries showed that 5.5 million HIV-positive individuals were screened for TB in 2013 compared with 4.1 million in 2012<sup>[103,70]</sup>.

HIV infection, and its associated immunosuppression, increases the risk of latent TB infection developing into active TB disease<sup>[104,105]</sup>. The annual risk of developing active TB is in excess of 10% for latently TB-infected, HIV-positive people<sup>[100,106,107]</sup>. After contact with tuberculosis bacteria, patients with HIV have twenty times the normal incidence of TB<sup>[56]</sup>. This risk can be reduced by IPT, but IPT prescriptions for the PLHIV group remains low<sup>[108,109]</sup>. Currently, the WHO TB symptom screening algorithm is recommended for TB screening in PLHIV<sup>[110]</sup>. The WHO TB symptom screening algorithm is simple, and it can be used at peripheral health facilities in resource-constrained settings, the symptom include current cough, fever, weight loss and night sweats<sup>[111]</sup>. It does not involve physical examination and laboratory testing. Low-resource countries may benefit from regular, provider-initiated screening using this<sup>[112]</sup>. This clinical tool triages HIV-positive individuals either for further TB testing or clinical interventions, including IPT administration and ART initiation. In a setting with 5% TB prevalence, the negative predictive value (NPV) of this rule reaches 97.7%<sup>[112,113]</sup>. Despite its inherent simplicity and the WHO's strong recommendation on intensified case identification among HIV-positive adults, the actual implementation of the algorithm lacks uniformity and has not achieved the desired coverage<sup>[114,115]</sup>. In 2013, 5.5 million people with HIV in 64 countries were screened for TB<sup>[101]</sup>.

Using the WHO TB symptom screening in environments with high TB prevalence, up to 80% of HIV-positive adults may show positive results and therefore need further investigations to ascertain their TB status<sup>[113,116]</sup>. The performance of the symptom screening algorithm is even poorer for persons receiving ART<sup>[116]</sup>. HIV-positive patients with TB and low CD4+ T-lymphocyte counts (<100 cells/mm<sup>3</sup>) more often present with atypical chest radiographs and negative acid-fast sputum smears than HIV-negative patients<sup>[117]</sup>.

Extrapulmonary TB (EPTB) is more common in HIV-positive individuals than HIV-negative patients<sup>[118,119]</sup>. In areas with a high HIV burden, more than 50% of HIV-associated TB cases are extrapulmonary<sup>[119,120]</sup>. The most frequent appearance of EPTB is lymphadenitis<sup>[121]</sup>. Other forms of EPT are tuberculomas in the brain, meningitis, pleuritis, osteomyelitis, peritonitis and genitourinary, gastrointestinal, and cutaneous diseases.

There is a lack of practical diagnostic methods for identifying TB cases among PLHIV in resource-limited environments<sup>[122]</sup>. This constitutes a substantial problem for health systems, with both direct financial costs and potential negative effects in the delay of ART initiation and administration of IPT, as people first have to undergo testing for TB<sup>[123]</sup>.

In a meta-analysis of 29 studies performed in China between 1995 and 2010, 0.9% (0.6%–1.4%) of the TB patients were HIV positive and the prevalence of TB among the HIV positive's was 7.2% (4.2%–12.3%), and when restricted to AIDS patients

22.8%<sup>[124]</sup>. Significantly higher prevalence of TB was observed for men and hospital-based populations<sup>[125]</sup>. The convergence of these two infectious diseases is increasingly and significantly endangering human health<sup>[125,126]</sup>.

Treatment of HIV-positive individuals with TB is given in the same principles as for HIV-negative persons; initiation of ART during the course of TB treatment is an important component that leads to improved survival, especially in individuals with advanced immunosuppression. Initiating ART during the first 4 weeks of TB treatment substantially reduces the case fatality<sup>[127]</sup>.

Successful ART will lead to the restoration of immune function. When people with advanced immunosuppression start to receive ART, they may develop a form of clinical deterioration known as Immune Reconstitution Inflammatory Syndrome (IRIS). This is due to an exaggerated inflammatory response directed at a range of co-infections when the patient starts receiving ART. IRIS can occur in cases of infections that are recognized and being treated (paradoxical IRIS), but may also manifest as “unmasking” IRIS. This means that a pre-existent infection, not recognized at the time of ART initiation, becomes clinically apparent along with immune reconstitution<sup>[128,129]</sup>. Consequently, a substantial proportion of HIV-positive individuals starting ART are found to have undiagnosed TB when they develop IRIS, while if no TB treatment is provided, this can result in high numbers of fatalities<sup>[130-133]</sup>. Both TB treatment and ART should be continued despite possible side-effects; adjunctive treatments such as steroids may be of benefit in severe cases. Early ART initiation during the course of TB treatment (especially within less than two weeks of TB treatment onset) in individuals with advanced immunosuppression increases the risk of TB IRIS<sup>[121]</sup>, but is also associated with substantially reduced mortality<sup>[127]</sup>.

#### **1.4 Quality of life among HIV positive patients**

For people living with HIV (PLHIV), antiretroviral therapy offers significantly prolonged survival rates. HIV-related stigma and discrimination pose a major barrier to HIV prevention and care worldwide<sup>[134-137]</sup>. This finding has emerged in various forms in health care settings, resulting in the refusal of care, suboptimal services, excessive precautions, isolation, mandatory testing, breaking of confidentiality rules, humiliation, and blame<sup>[136,138,139]</sup>, which discourage people from HIV testing and counseling and accessing treatment and care<sup>[140-142]</sup>. It is important to analyze the health-related quality of life (HRQL) and factors related to reduced HRQL among people on treatment for chronic diseases like HIV. This has not been studied previously in Xinjiang, China.

## **2. AIMS, GENERAL AND SPECIFIK OBJECTIVES**

The aims of the present study were to study the following aspects of HIV in Xinjiang:

- To assess knowledge of HIV/AIDS, attitudes among university students (Paper I) and pregnant women (Paper II).
- To investigate the prevention, prevalence, and cure rate of TB among HIV-positive patients (Paper III).
- To analyze quality of life among people living with HIV (Paper IV).

## **3. MATERIAL AND METHODS**

### **3.1 Definitions**

Diagnostic criteria for HIV : The patients were first screened for HIV in a ELISA test, and positive HIV tests were then confirmed at a local Centre of Disease Control and Prevention (CDC) using a Western Blot test.

Diagnostic criteria for tuberculosis according to the 2001 revised diagnostic criteria for the diagnosis and treatment of tuberculosis<sup>[143]</sup>: 1.Positive culture of Mycobacterium tuberculosis from sputum, tissue, blood, liver, spleen, lymph nodes, biopsy or pleural effusion. 2. Persistent high fever (> 38.5 °C) for more than two weeks, night sweats, more than 10% weight loss (3-6 months), weakness. 3.Positive tuberculin test (PPD), where the scleroma is moderate (10-19mm) or intense (>20mm, or with blister, local necrosis, lymphangitis). 4. Chest X-ray image change typical of tuberculosis. Patients with the first or two of the other factors were diagnosed with TB.

Cure of TB was defined as: patients surviving during treatment; previously smear-positive patients having negative smears; no remaining TB-related symptoms; improvement in X-ray findings; no relapse after the conclusion of TB treatment.

### **3.2 Patients populations and methods**

The material in Paper I was collected during spring 2004.The students who responded to the questionnaires and personal interviews were all studying at Xinjiang Medical University in Urumqi. The subjects studied were Western medicine, pharmacy, public health, acupuncture, traditional Chinese medicine, and stomatology.

In Paper II, questionnaires were given to consecutive pregnant women at eight antenatal clinics in Aksu city, China, in November 2005, and consisted of 32 questions divided into three categories: General questions, knowledge about HIV/AIDS, and attitudes toward HIV/AIDS. The questionnaire was modified from a

questionnaire constructed by Prof Glen Mola in Papua New Guinea<sup>[144]</sup>.

In Paper III, HIV-positive patients were identified at the HIV clinics of three city hospitals in Xinjiang, China. The cross-sectional retrospective study was carried out between November 2006 and December 2011. Register forms were used to collect data on demographic factors and clinical features. Clinical data were collected from individuals' hospital notes following a standardized protocol.

In Paper IV, a cross-sectional study was performed on all 679 HIV-positive patients on antiretroviral treatment at four hospitals in Urumqi, China, in 2013 and 2014. Patients had to have the physical and cognitive capability to participate in the study, and be aged 18 or older. We used the validated PROQOL-HIV questionnaire and a symptom questionnaire.

### **3.3 Statistical Methods**

The 95% confidence intervals (CI) for proportions were calculated using the formula: mean value (p)  $\pm 1.96\sqrt{p \times (100-p) / n}$ , where n is number of observations and p is proportion in per cent. The formula was used when  $p \times n > 500$  and  $(100-p) \times n > 500$ . If two intervals do not overlap the observed difference is statistically significant with  $p < 0.05$ . For comparison of proportions between groups we used a Chi-square test. The differences in hazard between groups were analyzed by a Cox proportional hazard analysis. Survival curves based on Kaplan-Meier estimates are presented. P-values  $< 0.05$  were regarded as statistically significant.

A confirmatory factor analysis (CFA) was used in Paper IV to verify the hypothesized four-domain scaling scheme (PHS, COG, REL, TRT) of the sample. A multi-group CFA (Multiple Indicator Multiple Cause (MIMIC) model) was used to assess the equivalence of factor mean scores across Uygur and Han patients. Standard fit indices were used to assess goodness-of-fit of CFA models, where it is usually considered that a comparative fit index (CFI) greater than 0.90 is indicative of adequate model fit, with values near 0.95 being preferable, and a root mean square error of approximation (RMSEA) below 0.08 (respectively 0.06) is indicative of acceptable (respectively good) model fit.

## **4. Ethical Considerations**

Study I was a voluntary questionnaire for university students and did not require ethical approval according to both Chinese and Swedish law. Study II was a voluntary questionnaire for pregnant women without the need for ethical approval according to Chinese law. The Swedish Ethics committee at Gothenburg University had no objections (Dnr 206-07). Study III and IV were approved by the Ethics Committee at the First Affiliated Hospital of Xinjiang Medical University (No:20090212-01).



## **5. RESULTS AND DISCUSSION**

### **5.1 Awareness of and Attitude to HIV/AIDS (Papers I and II)**

#### **HIV awareness among university students**

A total of 400 students filled out the questionnaire in 2004. This total was made up of : 352 first to fourth year undergraduate students studying at the Xinjiang Medical University in Urumqi, Xinjiang, with a mean of 2.3 years at university (ages 17 to 24 with a mean age of 20.8 years, 61% women ); 48 second year postgraduate students (ages 23 to 54 with mean age of 31.2 years, 73% women ).

Ninety-five per cent of the undergraduate students knew the most common routes of HIV transmission: sexual contact, mother to child, and sharing needles. Eighty per cent also knew about transmission through breastfeeding. There were, however, some knowledge gaps about how HIV is, and is not, transmitted. The questionnaires showed that only 5.7% of the undergraduate students admitted to being sexually active. Twenty-eight per cent of the undergraduates and 17% of the postgraduates said they would not tell anyone if they were infected with HIV. Among the undergraduate students the Han Chinese gave more correct answers than the Uygurs to all questions about routes of transmission. The difference was significant regarding the belief that HIV was transmitted by mosquitoes. Fifty-four per cent of the Uygurs and 35% of Han Chinese ( $p < 0.05$ ) believed this. Approximately half (54.5%) of the undergraduate students and 88% of the postgraduates said they knew the symptoms of HIV. All described accurately the symptoms of AIDS, where “weak immune defense/easy to get infections” was the most common answer. They all gave correct examples of symptoms, such as weight loss, ulcerations, weakness, Kaposi’s sarcoma, etc. However, knowledge seemed to be superficial with a lack of understanding of the details and nature of the disease. Most students were unable to give details about their answers when asked to, and they had some difficulties separating HIV from AIDS. Almost half of the postgraduates (44%) believed that there was a medicine that could cure HIV/AIDS; 13% did not know and 4% did not answer the question. Knowledge was much better among the undergraduate students, where just 9.4% believed that such a medicine existed. Regarding the questions about “wanting to be tested for HIV”, 61% of undergraduate students and 52% of postgraduates said they wanted to be tested.

The most obvious risk groups were identified: sex workers, drug users and “sex abusers,” meaning people with multiple sexual partners. One category frequently mentioned as a risk group were people with “low immunization,” which might point to a misunderstanding concerning the impact of the disease on the immune system.

The acceptance of HIV testing was similar to the findings from a study from Pakistan<sup>[145]</sup>. The misconceptions concerning mosquitoes and kissing as routes of transmission were also found in a study carried out at a Greek nursing school<sup>[146]</sup>.

In the interviews, the students' knowledge of HIV/AIDS seemed to be superficial, and lower than in a study of Thai University students<sup>[147]</sup>. Although they did not display high risk sexual behavior during the time of our study, attitudes are changing and attitudes to extra-marital sexual relations are becoming more liberal.

A study of university students in Wuhan, China, in 2004 showed that most of them were also unable to give details about HIV when asked to, and they also had some difficulties separating HIV from AIDS, However, knowledge had improved compared to a study at the same university in 2009<sup>[148]</sup>.

Many students in Xinjiang Medical University believed that there was a medicine that could cure HIV/AIDS. Perhaps the treatment of opportunist infections has been confused with antiviral treatment, which would also reveal a lack of knowledge concerning the effects of the treatment.

### **Awareness and attitudes among pregnant women**

Out of the 291 women in Aksu, northwestern China, who answered the questionnaires in 2005, 234 were Uyghur and 57 Han Chinese. Their ages ranged from 19 to 36 with a mean age of 27.5 years. Thirteen per cent of the Uyghurs and 79% of the Han Chinese respondents were living in the city. Most of the pregnant women had first heard about HIV/AIDS through the media. Many women referred to the AIDS awareness campaigns on the radio and TV.

We noted frequent misconceptions about the ways HIV was transmitted. Only 21% (95% CI 15.8-26.2%) of the Uyghur women could mention one symptom caused by HIV, compared to more than 90% (95% CI 82.2-97.8%) of the Han Chinese women. There are still people who have no knowledge of HIV.

Only 69% of the Uygur women and 58% of the Han Chinese women wanted an HIV test, which is lower than in a similar study among pregnant women in rural India in 2002, where 86% reported that they wanted an HIV test<sup>[149]</sup>. Our study results indicate that approximately one third of the pregnant women thought that HIV could be transmitted by social contact. This implies a high risk of excluding HIV-positive persons from social life. Most importantly, the risks of needle sharing and breastfeeding were poorly understood. It is possible that information about this is less likely to be delivered by the media, where most pregnant women obtained their HIV information. Finding socially-acceptable ways to educate pregnant women about these risks is essential to HIV prevention efforts.

Regarding the main routes of HIV transmission, 75% (95% CI 69-81%) of women in north-west China knew it can be transmitted through sexual intercourse. This was significantly lower than in the study from Uganda with 94% (95% CI 89.3-98.7%)<sup>[150]</sup>, and 98.5% (95% CI 96.8-100.2%) in a study from Ghana<sup>[151]</sup>. Avoiding breastfeeding was identified by 61% (95% CI 55-67%) in our study which is higher than in a study from Nigeria on 29.8% (95% CI 22.8-36.8%) of the respondents<sup>[152]</sup>, but lower than in Ghana at 89.0% (95% CI 84.5-93.5%).

The insufficient knowledge about mother-to-child transmission as a route of HIV transmission has also been identified in other studies<sup>[153-158]</sup>. In contrast to the studies mentioned above, two other similar studies conducted in India<sup>[159]</sup> and Papua New Guinea<sup>[144]</sup> report higher percentages, 80% and 69%, of women knowing about breastfeeding as a route of transmission. When it comes to knowledge about pregnancy and delivery as routes of transmission, around the same percentages of pregnant women in India and Papua New Guinea, as in a Hong Kong study<sup>[160]</sup> knew about them. Therefore our conclusion is the same as those of the Hong Kong study and the studies from India<sup>[155]</sup> and Ghana<sup>[156]</sup> that pregnant women did not know about means of reducing mother-to-child HIV infection.

Further campaigns in the media and additional efforts to continue to raise the level of awareness among the people of Aksu are essential. Testing and counselling for both men and women must be available free of charge, because primary HIV infection during pregnancy and breastfeeding poses an increased threat of mother-to-child transmission. Mothers who test HIV positive need personal counselling and support, with information about preventive antiretroviral therapy and, when medically-indicated, caesarean section, together with no breastfeeding or exclusive breastfeeding, to reduce the likelihood of mother-to-child transmission.

A higher level of awareness was seen in one study from south central China when those studied had higher levels of education, which suggests that education is an important influencing factor when it comes to awareness of HIV<sup>[158]</sup>. However, there are some studies<sup>[161-166]</sup> showing that the level of awareness and attitudes among pregnant women seemed to be superficial in different provinces in China. To conclude, more knowledge about MTCT is needed in China.

## **5.2 HIV with TB co-infection (Paper III)**

In a retrospective study between 2006 and 2011, clinical and laboratory data on 333 patients with HIV and TB were compared with 2668 patients with HIV only. The mean age of the patients with HIV+TB was 40.7 years (95% CI 35.4-46), compared to the patients with HIV only, at 40.6 (95% CI 38.8-42.2). Thirty-eight patients (11.4%) had EPTB, of which 28 (74%) were men. For the patients with EPTB the mean age was 39.2 years (median 38, range 27-52).

The main route of HIV infection among patients with HIV+TB was IVDU at 58.3% (95% CI 53%-63.6%), which was significantly higher than for patients with HIV only, at 38.9% (95% CI 37.1%-40.7%), ( $p < 0.05$ ). Of the patients with HIV+TB 72.7% (95% CI 68%-77.4%) were men, compared to 55.3% (95% CI 53.4%-57.2%) for patients with HIV only. Of the patients with HIV+TB 72.7% (95% CI 68%-77.4%) were men, compared to 55.3% (95% CI 53.4%-57.2%) for patients with HIV only.

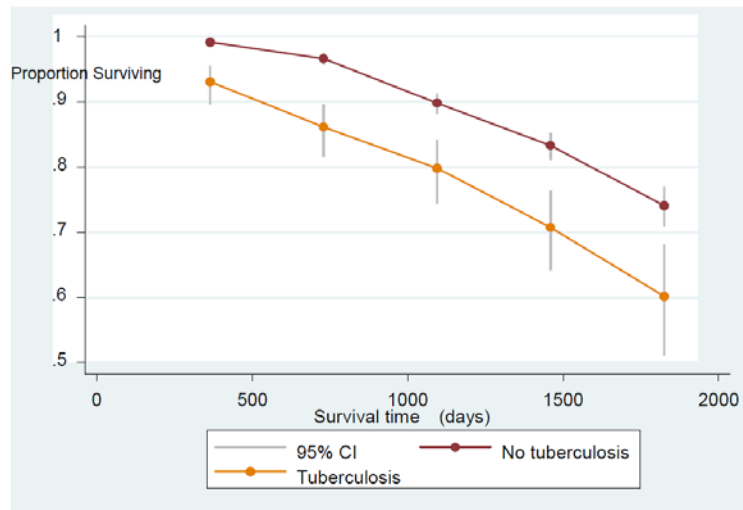
The prevalence of TB co-infection among the HIV positive patients was 11% (95% CI:10%-12%), which was significantly higher than the national figure in China on 2%<sup>[167]</sup> in 2012, and similar to a study from Tanzania where the figure was 5.3% (95% CI:0-10.6%)<sup>[168]</sup>. Among the patients fulfilling the criteria for isoniazid preventive therapy (IPT), only 57.9% received the prophylaxis. For patients who were intravenous drug users (IVDU) 51.4% got IPT compared to 63.1% for non-IVDUs ( $p < 0.05$ ).

In our study, treatment for both HIV and TB was given to 87.7% patients with dual infections. In China as a whole, only 23% of TB patients were tested for HIV in 2011, with 4715 (2%) being HIV positive out of which only 1677 (36%) received ART<sup>[169]</sup>. The WHO's recommendation is that all HIV-positive TB patients are eligible for ART<sup>[170]</sup>.

EPTB was seen among 11.4% in our study. We found that in our cases the most common types of EPTB were lymphadenitis (53%) and pleural TB (18%). Peto et al. published a wide series of EPT cases from the USA and revealed that lymphatic (40%) and pleural (19.8%) types of EPTB were the most frequent, and meningeal involvement was found in 5.4% of their cases<sup>[171]</sup>.

The one-year cure rate in our study was 69.2% (Figure 4), lower than the officially reported 91.4% of all TB cases in Xinjiang 2011<sup>[172]</sup>, but not significantly different to a study from Zimbabwe where the figure was 70%<sup>[173]</sup>.

The hazard of not surviving over the five years after diagnosis of HIV was significantly higher in patients with HIV+TB compared to HIV only, after adjusting for sex and IVDU with HR=1.84 (95% CI 1.43-2.35;  $p < 0.0001$ ).



**Figure 4:** Survival time in 333 patients with HIV+tuberculosis and in 2668 with HIV only.

The cure rate for EPTB was 34.2%, which is similar to a study from Taiwan at 28.7%<sup>[174]</sup>. Mortality among patients with EPTB was 36.8% in our study, compared to 14.7% in a study from the United States<sup>[175]</sup>.

Low TB cure rate among patients with HIV may be due to a late HIV diagnosis, by which time immunodeficiency can be advanced. Insufficient control of patient adherence to treatment makes it impossible to evaluate if that can be a cause of the low cure rate.

Xinjiang, located in central Asia, has probably high rates of MDR-TB<sup>[176]</sup>. However, tests for resistance were not performed, which was an obstacle to the optimal treatment and control of TB. Many health systems and national TB programs have performed poorly during the past two decades<sup>[177]</sup>. Another important issue has been the failure to provide free treatment for drug-susceptible disease, which created an ideal environment for the development of drug resistance<sup>[178]</sup>.

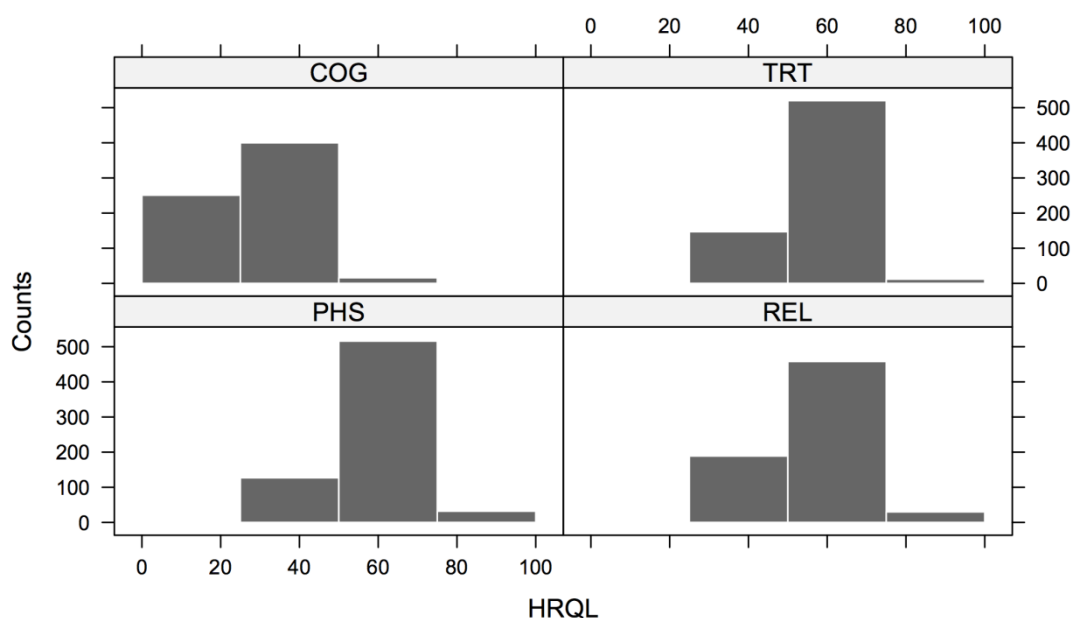
In Xinjiang the patients' living conditions are often poor, with people crowded into the same rooms to reduce the costs of heating. In the case of TB, many could not afford to seek treatment for symptoms because of lack of money. Even if the TB drugs are free for patients, they have to pay for travel costs, tests and hospital care. Not seeking medical help can lead to delayed diagnosis and treatment and an increased risk of the spread of TB. According to the results of a national general survey of tuberculosis from 2001 to 2010 in China, only 47% of patients with pulmonary tuberculosis went to hospitals, and knowledge of how to prevent and control TB was only 57%<sup>[179]</sup>.

### 5.3 Quality of life of HIV-positive patients (Paper IV)

Of the 500 (74%) Uygurs among the 679 patients in this study, which was performed in 2013 and 14, 279 (68%) were men. The mean age was 40 (median 40, range 20 to 84) for men, and 38.6 ( median 38, range 21 to 61) for women. Fifty-two per cent of them were single, divorced or widowed. Two hundred and eighty-two (42%) had only primary school education level, and 338 (50%) were unemployed.

More single patients were in the IVDU group (25%) than in the non-IVDU group (15%) ( $p=0.044$ ). Patients with IVDU had a higher prevalence of hepatitis B (25%) compared to 13% of patients in the non-IVDU ( $P<0.001$ ) group.

The HRQL score was low, especially on the health concerns, body image and mental distress (COG) dimensions as shown in Figure 5:

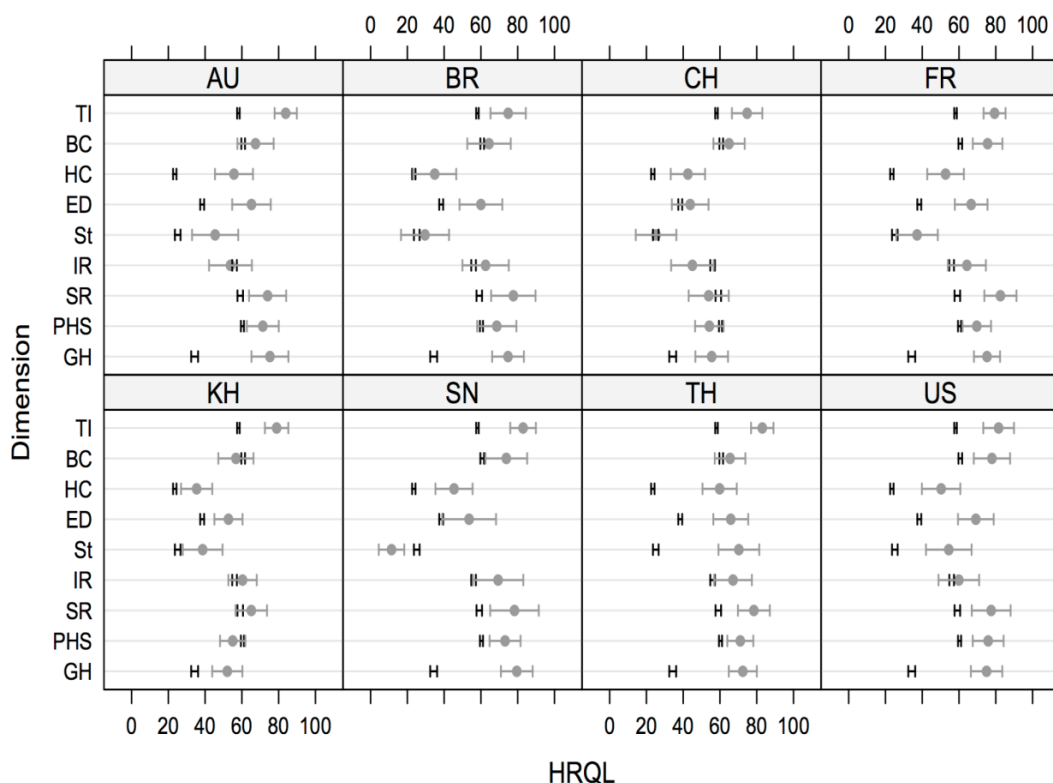


**Figure 5:** Distribution of individual scale scores among 679 patients in Xinjiang, China using the simplified 4-factor scoring scheme of the PROQOL-HIV questionnaire with the dimensions of health related quality of life (HRQL): COG (health concerns and mental distress); TRT (treatment-related impact); PHS ( physical health and symptoms); REL ( social and intimate relationships ).

The results from the PROQOL-HIV questionnaire also showed that 86% of the patients were afraid to tell others they are HIV positive, 84% worried about the follow-up results, 73% were afraid that their condition should worsen, 55% had fears of infecting others, 70% had financial difficulties and 23% of patients felt their relationships with family or friends were limited by the disease. Sixty-nine per cent were reported depressed by doctors but only 1% were on antidepressant treatment. Seventy-three per cent reported their religious belief helped them live with HIV. There

were no significant differences in the findings regarding HRQL between men and women, Han Chinese and Uygur.

The patients in our study had low HRQL compared to results from studies of patients in France, Brazil, Cambodia, Senegal, Thailand, USA, central southern China<sup>[180]</sup> and Australia<sup>[181]</sup>, as shown in Figure 6.



**Figure 6.** Comparison of health-related quality of life (HRQL) between Xinjiang 2013-14 (marked as 95 % CI in bold) with studies performed in 2009 in Australia (AU), Brazil (BR), Central-South China (CH), France (FR), Cambodia (KH), Senegal(SN), Thailand (TH) and USA(US) marked as mean with 95% CI.

HRQL is described in the eight dimensions of PROQOL-HIV: treatment impact (TI), body change (BC), health concerns (HC), emotional distress (ED), stigma (St), intimate relationships (IR), social relationships (SR), physical health and symptoms (PHS), and summarized variable general health (GH).

In particular they had low scores for ST, ED, HC and COG, indicating that they had experienced more stigma, emotional distress, health concerns and mental distress than patients in other countries and southern central China. A major step in the right direction will have to include a more serious effort to reduce stigmatization and discrimination as it relates to people living with HIV/AIDS or at high risk of contracting the disease. This approach is particularly important among ethnic populations in Xinjiang, who already face discrimination and stigmatization regardless of their HIV status.

## **6. GENERAL CONCLUSIONS**

Xinjiang has a high prevalence of HIV and TB, but our study showed that knowledge about HIV among students, pregnant women and people living with HIV was limited and needs to be improved.

To reduce the incidence of tuberculosis and improve the cure rate a number of measures are needed. They include the earlier diagnosis and treatment of HIV, testing drug resistance of tuberculosis patients, implementing isoniazid prophylaxis and monitoring adherence to HIV and TB treatments.

The low quality of life among patients indicates a need for increased medical and social support.

## **7. FUTURE PERSPECTIVES**

The problem of HIV/AIDS in Xinjiang is a focal point around which a number of other challenges converge. Drug trafficking is one good example. HIV is spread primarily through shared needles among IDUs. Drug use is on the rise in Xinjiang, which has become an important drug trafficking route, and HIV prevalence among IDUs in the region is remarkably high.

As Xinjiang develops and becomes an increasingly more open and lucrative place for economic activity, there will also be an increase in the interaction between people engaged in risky activities such as drug trafficking, injecting drug use, and commercial sex.

Combating HIV/AIDS is not only a challenge that concerns public health authorities, but requires the active and effective cooperation of a range of other governmental agencies including public security, justice, public information, broadcasting, education and culture, transportation, commerce, finance, and ethnic and religious agencies, among others. Civil society organizations and other non-governmental groups, including the private business sector, should be encouraged to take a more active part in the fight against HIV in Xinjiang.

Finally, there is a glaring need for greater cross-border cooperation between China and its central Asian neighbors to combat HIV and the risky behaviors which facilitate its transmission.



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