International Journal of Infectious Diseases 104 (2021) 510–525

Contents lists available at ScienceDirect

International Journal of Infectious Diseases

journal homepage: www.elsevier.com/locate/ijid

Prevalence of HIV, HCV and HBV in Central Asia and the Caucasus: A systematic review

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ARTICLE INFO

Article history:
Received 18 October 2020
Received in revised form 22 December 2020
Accepted 23 December 2020

Keywords:
Human immunodeficiency virus
Hepatitis C virus
Hepatitis B virus
Central Asia
Caucasus

ABSTRACT

Background: Human immunodeficiency virus (HIV), hepatitis C virus (HCV) and hepatitis B virus (HBV) are substantial public health threats in the region of Central Asia and the Caucasus, where the prevalence of these infections is currently rising.
Methods: A systematic review of MEDLINE, Embase and PsycINFO was conducted with no publication date or language restrictions through October 2019. Additional data were also harvested from national surveillance reports, references found in discovered sources, and other "grey" literature. It included studies conducted on high-risk populations (people who inject drugs (PWID), female sex workers (FSW), men who have sex with men (MSM), prisoners, and migrants) in Central Asia: Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan; and the Caucasus: Armenia, Azerbaijan, Georgia, and Northern Caucasus region of the Russian Federation.
Results: Wide ranges were noted for HIV prevalence: PWID 0–30.1%, MSM 0–25.1%, prisoners 0–22.8%, FSW 0–10.0%, and migrants 0.06–1.5%, with the highest prevalence of these high-risk groups reported in Kazakhstan (for PWID), Georgia (for MSM and prisoners) and Uzbekistan (for migrants). HCV prevalence also had a wide range: PWID 0.3–92.1%, MSM 0–18.9%, prisoners 23.8–49.7%, FSW 3.3–17.8%, and migrants 0.5–26.5%, with the highest prevalence reported in Georgia (92.1%), Kyrgyzstan (49.7%), and migrants from Tajikistan and Uzbekistan (26.5%). Similarly, HBV prevalence had a wide range: PWID 2.8–79.7%, MSM 0–22.2%, prisoners 2.7–6.2%, FSW 18.4% (one study), and migrants 0.3–15.7%.
Conclusion: In Central Asia and the Caucasus, prevalence of HIV, HCV and HBV remains exceedingly high among selected populations, notably PWID and MSM.

Introduction

Human immunodeficiency virus (HIV), hepatitis C virus (HCV) and hepatitis B virus (HBV) are transmitted through blood-borne, sexual or perinatal routes; infection with one is an indicator of possible co-infection with the others. Key high-risk populations are: people who inject drugs (PWID), commercial sex workers (CSW; of whom a subset are female sex workers [FSW]), men who have sex with men (MSM), and prisoners (UNAIDS, 2019a), while migrants may also be at higher risk. In 2016, 104.6 million deaths worldwide were caused by HIV, HBV and HCV combined; 60 million deaths were attributed to HIV/AIDS; and 35 million and 9.8 million deaths were associated with HBV and HCV, respectively (World Health Organization, 2018). Eastern Europe and Central Asia have been the regions with the highest incidence rates of new HIV cases over the last decade, with 100,000 new HIV infections in 2019 alone (UNAIDS, 2019b). In Eastern Europe and Central Asia, 95% of all new HIV infections are reported among the key high-risk populations: PWID, CSW, MSM, prisoners, and their sexual partners (UNAIDS, 2019a).

Following the collapse of the Soviet Union in 1991, 15 countries gained independence: Armenia, Azerbaijan, Belarus, Estonia, Georgia, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Moldova,

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https://doi.org/10.1016/j.ijid.2020.12.068

Russia, Tajikistan, Turkmenistan, Ukraine, and Uzbekistan (Burke, 2014). Open border policies within the former Soviet Union (FSU) region promoted travel and trade, but also facilitated transmission of infectious diseases. Some of the FSU countries are historically grouped based on administrative classification used during the period of the Russian Empire. Central Asia includes Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan. Another sub-region is Caucasus, which comprises Armenia, Azerbaijan, Georgia, and part of Russia also known as Northern Caucasus (Owen et al., 2019) (Figure 1).

The current study sought to compile a systematic review of studies assessing prevalence of HIV, HBV and HCV among key populations–including PWID, FSW, MSM, prisoners, and migrants–in the Central Asia and Caucasus countries (Figure 1).

Methods

Data sources and search strategy

The Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines were used for this project (see PROSMA checklist, Supplementary Table S1) (Moher et al., 2009). This review was registered in the PROSPERO database (ID 100499) in June 2018. The review focused on eight independent countries of Central Asia and the Caucasus (Southern Caucasus), as well as North Caucasus, which is currently part of Russia (Figure 1). The following scientific databases were searched up to 03 October 2019: MEDLINE, Embase and PsycINFO, with no publication date or language restrictions. The search strategy described in Supplementary Table S2 was used to identify articles of interest in the databases. Additionally, primary sources related to the subject and area of interest cited in all relevant papers and reviews were identified and included. For non-peer reviewed "grey" literature, websites of the ministries of health and of non-governmental organizations (NGOs) that focused on HIV and AIDS, as well as Google search were consulted (Supplementary Table S3). Additionally, several AIDS centers were reached via telephone and requested to provide integrated bio-behavioral surveillance (IBBS) reports. Vulnerable populations were defined as communities exposed to higher risk of acquiring an infection, such as HIV, HBV or HCV, based on certain socioeconomic factors. For the purpose of this study, the following groups were considered as vulnerable populations: people who inject drugs (PWID), female sex workers (FSW), men who have sex with men (MSM), prisoners, and migrants.

Study selection

First, two authors (SD and ZHJ) independently screened all titles and abstracts using Covidence™ software. If consensus was not reached, SHV or SHA provided input on whether to include a reference. Second, full texts of potentially eligible articles were retrieved and assessed based on the following criteria: (1) sample size clearly stated; (2) population identified (PWID, MSM, FSW, prisoners, migrants); (3) year and place of the study/survey given; (4) prevalence data on one or more of the viruses (HIV, HBV or HCV) in question provided; (5) laboratory technique given (ideally with its validation described); and (6) research methodology (sampling strategy, survey methodology) provided. Only studies containing primary data were included for data extraction. Findings that were published in several papers were extracted only once based on the paper/report that provided the most detailed information. For documents/articles that were not in English, Russian, French, or other languages spoken by the authors, one author (SD) used Google Translate or asked a native speaker to help to assess eligibility.

Data extraction

Data were extracted by two authors (SD and ZHJ) using the full texts in English (SD and ZHJ) and Russian (SD) languages. To minimize human error for full text in Russian, data were extracted twice from each article by SD, consulting with others as needed.

Quality of evidence

Quality of data was ascertained by applying the following criteria: (1) the prevalence of infection (HIV, HBV and HCV) and the sample size was described; (2) the geographic site was mentioned and it was located in the area of interest; (3) the population of interest (PWID, MSM, FSW, prisoners, and migrants) was clearly described; and (4) the laboratory technique used for the measurement was clearly described. Since data for the region of study were sparse, no restrictions were imposed on study sample sizes, in order to include as much data as possible.

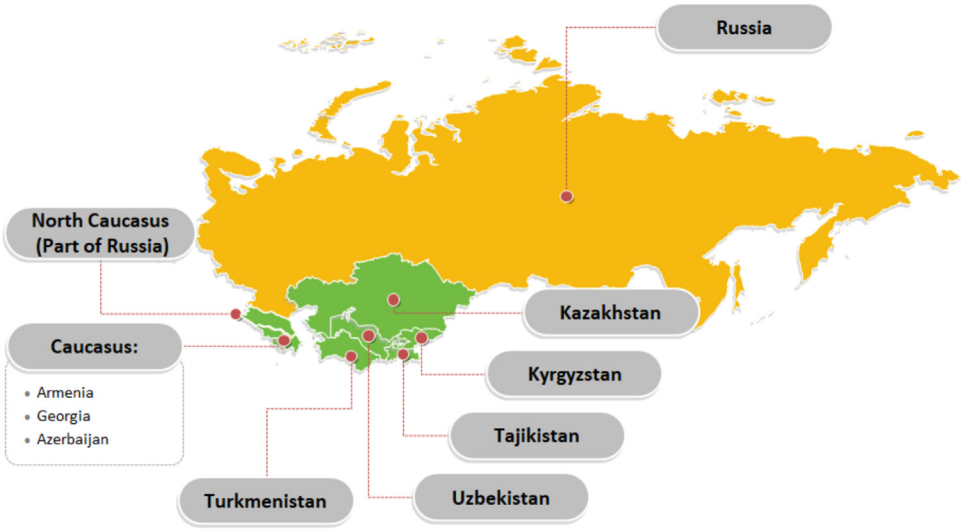

Figure 1. Map of the Central Asia and Caucasus. Area of research interest is marked in green. North Caucasus (also in green) is a part of the Russian Federation (in yellow).

Results

Results of search strategy

A total of 5,242 citations were retrieved from MEDLINE, Embase, PsycINFO, and the "grey" literature, including 147 citations, mentioned in the relevant papers and reviews. Based on title and abstract relevance, 2,032 unique citations went into the full-text screening, of which 61 citations were eligible for data extraction (Figure 2).

Scope and quality of the evidence

Search results

The largest number of studies, both for peer-reviewed articles and IBBS reports, were retrieved for Georgia (24 citations), followed by Armenia (nine citations) and Kazakhstan (eight citations). Georgian citations mainly covered Tbilisi and Batumi; Armenian studies were performed in the main cities of Yerevan, Gyumri, Vanadzor; while in Kazakhstan the prevalence of infections was mostly measured in Almaty. There were several reports on HBV and HCV prevalence among general populations in areas of the Northern Caucasus, published between 1996–2006.

Quality assessment

All but two studies had samples sizes ≥100 people. Papers that did not describe the target population and/or failed to indicate the lab assays that were used were excluded. For HIV testing, 70% of the studies mentioned Western blot confirmatory test for ELISA-positive results, while enzyme immunoassays were employed for all HBV and HCV lab tests. For each viral infection–HIV, HCV and HBV – the overall prevalence per country was presented, then detailed information for each key population (PWID, CSW, MSM, prisoners, and migrants) was presented, and on sub-regions: Central Asia and the Caucasus region.

HIV prevalence

Central Asia

In Kazakhstan, HIV prevalence in 12 surveys varied from 0.06 to 30.1% (median 12.0%). The highest prevalence in Kazakhstan (30.1%) was reported among women who injected drugs. There were no citations found on prisoners or CSWs; one was found on the MSM population (20.2% prevalence) (Table 1A). In Kyrgyzstan, HIV prevalence in 11 surveys varied from 1.97 to 14.3% (median 7.6%). All citations were based on IBBS reports in four populations: PWID, MSM, FSW, and prisoners. PWID had the highest prevalence (14.3%) and HIV prevalence among their sex partners was also high (5.0%). HIV prevalence among MSM was cited in two reports to be 6.6% and 13.2%, while among prisoners it ranged 7.6–11.3%. For Tajikistan, the search yielded four eligible papers on HIV prevalence. Of the three among PWID, HIV prevalence ranged 1.8–12.1% (median 12%) (Table 1A). For Uzbekistan, seven surveys were found reporting HIV prevalence in the range 0–29.8% (median 3.9%), with the highest prevalence (29.8%) reported for PWID (Table 1A).

Caucasus region

In Armenia, HIV prevalence varied from 0 to 10.9% (median 0.5%). Of nine citations, eight were IBBS reports focusing on the major Armenian cities of Yerevan (the capital), Vanadzor and Gyumri. Among 10 surveys for PWID, HIV prevalence ranged 0–10.9% (median 1.1%). The search on FSW yielded eight surveys with a range of 0–0.6% (median 0%). Among MSM, HIV prevalence was between 0–2.7% in nine surveys (median 0.8%). Five studies on migrants in Armenia published within the last 5 years reported HIV

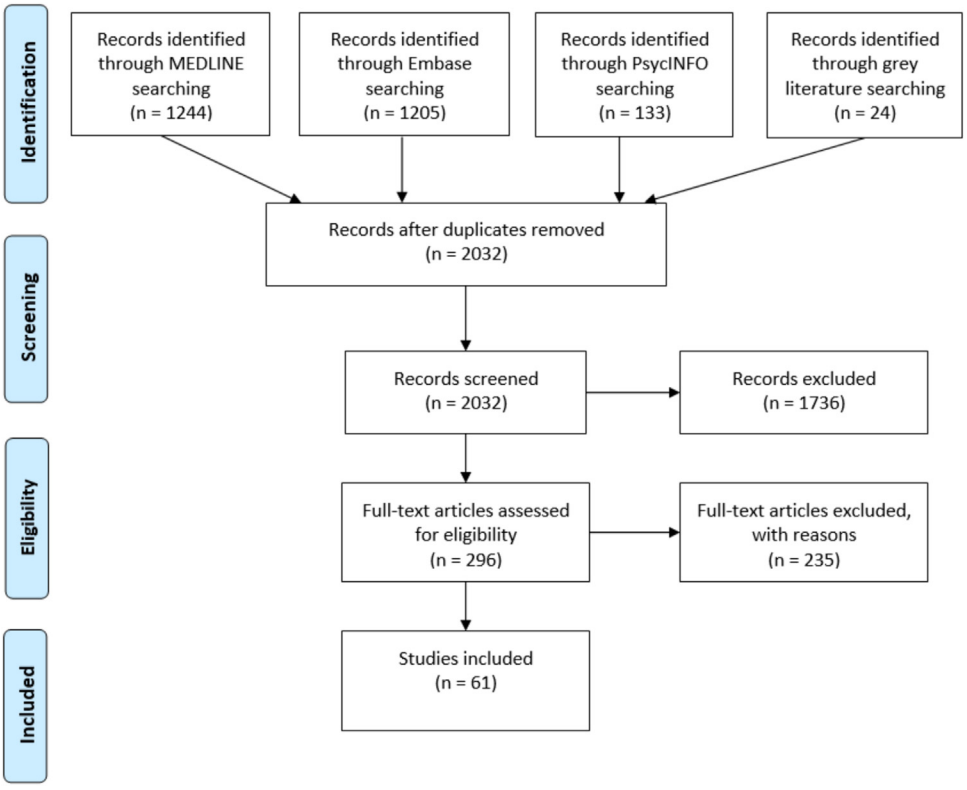

Figure 2. PRISMA chart.

Table 1A
HIV prevalence in Central Asia.

Reference (Survey dates)	Population	Country (area/city)	Type of Survey	Prevalence % (n)	Assay (kit or type)
Berry et al. (2012) (Apr–Aug, 2010)	MSM	KZ (Almaty)	CS	20.2% (400)	ICT[1]
Deryabina and Kryukova (2014) (Jun-Aug, 2013)	SP PWID	KZ (Ust-Kamenogorsk, Pavlodar, Temirtau, Kostanai)	CS	7.5% (1125)	ELISA*
El-Bassel et al. (2016) (2010-2013)	Migrants	KZ (Almaty)	CS	0.2% (1342)	ELISA (AntiHIV[1])
El-Bassel et al. (2014) (2009-2012)	FP PWID	KZ (Almaty)	CS	10.4% (135)	ELISA (AntiHIV[1])
	FWID	KZ (Almaty)	CS	30.1% (316)	ELISA (AntiHIV[1])
El-Bassel et al. (2011) (Jul-Oct, 2007)	Migrants	KZ (Almaty)	CS	0.2% (422)	ELISA (AntiHIV[1])
El-Bassel et al. (2013)	PWID and SP PWID	KZ (Almaty)	CS	25.1% (728)	ELISA (AntiHIV[1])
	PWID	KZ (Almaty)	CS	28.8% (580)	ELISA (AntiHIV[1])
El-Bassel and Marotta (2017) (2010-2013)	Migrants	KZ (Almaty)	CS	0.06% (1342)	ELISA (AntiHIV[1])
Zhussupov et al. (2007) (May-Aug, 2002)	PWID	KZ	IBBS	13.5% (1782)	EIA (AntiHIV[1]), immunoblot
	PWID	Temirtau		24.7% (896)	
	PWID	Karaganda		2.3% (886)	
Azbel et al. (2016) (Jul-Nov, 2014)	Prisoners	KG	IBBS	10.3% (368)	ELISA[3]
Mamaev (2007) (2005)	FSW	KG (Osh)	IBBS	2% (200)	ELISA[7] + c. (AntiHIV[1])
Chokmorova et al. (2013) (2013)	Various populations:	KG	IBBS		EIA*
	PWID	KG		12.4% (904)	
	FSW	KG		2.2% (855)	
	MSM	KG		13% (190)	
	Prisoners	KG		7.6% (750)	
Deryabina and Dooronbekova (2015) (Jun-Aug, 2013)	SP PWID	KG	IBBS	5% (857)	EIA*
Kadyrbekov et al. (2017) (Aug-Oct, 2016)	Various populations:	KG	IBBS		EIA*
	Prisoners	KG		11.3% (994)	EIA*
	PWID	KG		14.3% (1311)	EIA*
	MSM	KG		6.6% (640)	EIA*
	FSW	KG		1.97% (760)	EIA*
Stachowiak et al. (2006) (2004)	PWID	TJ (Dushanbe)	CS	12% (489)	OraQuick[1] + ELISA[7]
Beyrer et al. (2009) (May-Nov, 2004)	PWID	TJ (Dushanbe)	CS	12.1% (488)	OraQuick[1] + ELISA[7]
Gulov et al. (2016) (Mar-Aug, 2015)	MSM	TJ (Dushanbe)	CS	2.6% (502)	N/a
Kan et al. (2018) (Oct, 2016 - Jun, 2017)	PWID	TJ	IBBS	1.8% (10300)	EIA (OraQuick[2]) + c.
Alibayeva et al. (2007) (Apr, 2003 - Mar, 2004)	FSW	UZ (Tashkent)	CS	0.1% (448)	EIA[3] + WB c. (HIV BLOT[1])
Ruzibakiev et al. (2001) (1999-2000)	Various populations:	UZ	CS		PAT[1]
	PWID	UZ	CS	3.9% (51)	
	FSW	UZ	CS	0% (87)	
	MSM	UZ	CS	0% (9)	
Sanchez et al. (2006) (Apr, 2003 - Mar, 2004)	PWID	UZ (Tashkent)	IBBS	29.8% (701)	ELISA[4] + WB c. (Orasure[1])
Todd et al. (2006) (Apr, 2003 - Mar, 2004)	FSW	UZ (Tashkent)	CS	10% (448)	EIA[3]+ WB c. (HIV BLOT[1])
Todd et al. (2009) (Jul, 2004 - Jul, 2005)	FSW + MSW	UZ (Samarkand)	CS	6.18% (372)	ELISA[5] + WB c. (HIV BLOT[1])

prevalence between 0.2–1.3% (median 0.5%) (seven surveys). From the region of study, the only study on Armenian transgender persons reported 2.2% prevalence in 2018 (Table 1B). The search for Azerbaijan yielded three citations on HIV prevalence: two for migrants, including truck drivers (1.0–1.5%), and one for prisoners (3.7%) (Table 1B). The search yielded the highest number of citations for Georgia–most of which were based on IBBS reports and many covered up to seven cities all over the country. In Georgia, HIV prevalence varied from 0 to 25.1%, with a median 2% (51 surveys); prevalence was the highest among MSM: 6.2–25.1% (median 15.6%) (seven surveys). Among PWID, prevalence was between 0–18.6% (median 2%) (28 surveys). HIV prevalence among FSW ranged 0–1.9% (median of 0.8%) (10 surveys). Three studies were conducted for prisoners, reporting HIV prevalence from 0.3 to 22.8% (median 2%). One citation was found for migrant populations, reporting 0.6% HIV prevalence (Table 1B).

HCV prevalence

Central Asia

From Central Asia, the highest HCV prevalence was reported in Kazakhstan: 90.1% among PWID (Table 2A). The prevalence among PWID ranged 74.2–90.2% (median 85.3%), with lower prevalence for sex partners: 14.8–25.8%. In Kyrgyzstan, HCV prevalence from IBBS reports varied from 2.2 to 60.9% (median 15.8%) (11 surveys). Thus, among PWID, HCV prevalence was the highest – 45.2% and 60.9% (median 53%)–from two separate reports; followed by prisoners–34.5% and 49.7% (median 42.1%); FSW–3.3% and 5.5% (median 4.4%); and MSM–2.2% and 7.3% (median 4.8%) (Table 2A). Studies on migrants to Russia and Israel reported a prevalence of 4.8% and 26.5%, respectively (median 15.6%). The PWID population showed a relatively high prevalence of 61.3% (Table 2A). In Uzbekistan, HCV prevalence ranged 4.5–62.7% (median 11%) among PWID. One study on a mixed population of migrants from Uzbekistan and Tajikistan to Russia reported 4.5% (n = 464) HCV prevalence (Table 2A).

Caucasus region

In Armenia, HCV prevalence varied from 0.5% (among migrants) to 81.8% (among PWID), with a median of 11.1%. One report on prisoners reported 23.8% HCV-positive persons among 542 prisoners. Prevalence among PWID ranged between 7.9% (in Gyumri) and 81.8% (in Vanadzor) (median 46.6%). Among the migrant population, HCV prevalence was reported as 0.5–3.6% (median 2.7%) (Table 2B). The search on Azerbaijan yielded two eligible citations: one on prisoners with a prevalence of 38.2% (n = 510) and another on PWID with a prevalence of 51.1% (n = 425) (Table 2B). Quite a substantial focus on measuring HCV prevalence was observed in Georgia. Here, the prevalence was between 0–92.1%, with a median of 50.6% (30 surveys); both indicators were the highest in Caucasus. Most of the studies were performed on PWID, with prevalence 0.28–92.1%, median 65.6% (20 surveys).

Table 1B
HIV prevalence in Caucasus.

Reference (Survey dates)	Population	Country (area/city)	Type of Survey	Prevalence % (n)	Assay (kit or type)
Johnston (2019) (Feb-Mar, 2018)	Migrants	AM, GE, AZ	IBBS		ELISA*
	Migrants	AM		0.5% (300)	
	Migrants	AZ		1% (300)	
	Migrants	GE		0.6% (350)	
Azbel et al. (2015) (Feb-May, 2014)	Prisoners	AZ	IBBS	3.7% (510)	ELISA[6] + WB c. (LAV Blot[1])
Botros et al. (2009) (Jul, 2004–Oct, 2005)	TD	AZ (Baku)	CS	1.54% (3763)	ICT[2] + OraQuick[2]
Bouscaillou et al. (2014) (Oct 2012)	PWID	GE (Tbilisi)	CS	0% (216)	ELISA[12]
Chikovani et al. (2011) (2009)	PWID	GE (5 cities)	IBBS	1.99% (1108)	EIA[3] + WB c. (HIV BLOT[1])
Dershem et al. (2007) (Oct-Nov, 2004)	FSW	GE (Batumi)	IBBS	0% (120)	EIA[3] + EIA[5] + WB c. (HIV blot[1])
Dershem et al. (2007) (May-Jun, 2006)	FSW	GE (Batumi)	IBBS	0.1% (114)	EIA[3] + EIA[5] + WB c. (HIV blot[1])
Kuniholm et al. (2008a) (Oct, 1997- June, 1998)	PWID	GE (Tbilisi, Batumi, Poti)	CS	0.5% (926)	EIA (AntiHIV[1]) + WB c. (DuPont[1])
Shapatava et al. (2006) (2000-2001)	PWID	GE	IBBS	1.7% (583)	ELISA[8] + WB c. (DuPont[1])
Sharvadze et al. (2006) (2003-2005)	Pts with Herpes Zoster, incl:	GE	IBBS	18.9% (164)	ELISA + WB c.*
	Prisoners	GE	IBBS	22.8% (57)	
	PWID	GE	IBBS	18.6% (59)	
	Mixed (MSM, HBV+, HCV+)	GE	IBBS	14.5% (48)	
Shengelia et al. (2017) (2014-2015)	PWID	GE	IBBS	2.2% (2022)	EIA[4]+ WB c. (HIV Blot[2])
Chikovani et al. (2013a) (Feb-Aug 2012)	PWID	GE	IBBS		EIA[4] + WB c. (HIV Blot[2])
	PWID	Tbilisi		1.9% (350)	
	PWID	Gori		1.1% (280)	
	PWID	Telavi		0.4% (280)	
	PWID	Zugdidi		9.1% (280)	
	PWID	Batumi		5.6% (270)	
	PWID	Kutaisi		2.1% (280)	
Chikovani et al. (2017)	PWID	GE	IBBS		EIA[4] + WB c. (HIV Blot[2])
	PWID	Tbilisi		1.2% (370)	
	PWID	Gori		3.4% (280)	
	PWID	Telavi		2% (280)	
	PWID	Zugdidi		1.8% (280)	
	PWID	Batumi		5.1% (280)	
	PWID	Kutaisi		3.3% (280)	
	PWID	Rustavi		0.9% (280)	
Chikovani et al. (2015) (Nov, 2014 - May, 2015)	PWID	GE	IBBS		EIA[4]+ WB c. (HIV Blot[2])
	PWID	Tbilisi		2% (357)	
	PWID	Gori		2.4% (287)	
	PWID	Telavi		1.2% (285)	
	PWID	Zugdidi		4.8% (286)	
	PWID	Batumi		4.4% (277)	
	PWID	Kutaisi		2.6% (284)	
	PWID	Rustavi		0.9% (246)	
Tsereteli et al. (2013a) (Sep-Oct, 2012)	Prisoners	GE	IBBS	0.3% (286)	EIA[4]+ WB c. (HIV Blot[2])
Tsereteli et al. (2015a) (Oct-Nov, 2015)	Prisoners	GE	IBBS	2% (301)	ELISA[11] +WB c. (HIV Blot[2])
Tsereteli et al. (2015b) (Feb-Apr, 2015)	MSM	GE	IBBS		ELISA[11] +WB c. (HIV Blot[2])
	MSM	Tbilisi		25.1% (300)	
	MSM	Batumi		22.3% (115)	
Tsereteli et al. (2017) (Mar-Apr, 2017)	FSW	GE	IBBS		EIA[4]+WB c. (HIV Blot[2])
	FSW	Tbilisi		1.5% (195)	
	FSW	Batumi		0% (150)	
Tsereteli et al. (2014) (Mar-Apr, 2014)	FSW	GE	IBBS		ELISA[11] + WB c. (HIV Blot[2])
	FSW	Tbilisi		0.6% (157)	
	FSW	Batumi		0.8% (120)	
Chikovani et al. (2013b) (Oct-Dec, 2012)	MSM	GE (Tbilisi)	IBBS	13% (216)	EIA[4]+WB c. (HIV Blot[2])
Tsereteli et al. (2013b) (Mar-Apr, 2012)	FSW	GE	IBBS		EIA[4]+WB c. (HIV Blot[2])
	FSW	Tbilisi		1.3% (156)	
	FSW	Batumi		0.8% (120)	
Tsereteli et al. (2008) (Dec, 2008-Mar, 2009)	FSW	GE	IBBS		EIA[4]+WB c. (HIV Blot[2])
	FSW	Tbilisi		1.9% (154)	
	FSW	Batumi		0.8% (199)	
Tsereteli et al. (2018) (Oct-Dec, 2018)	MSM	GE	IBBS		ELISA[13] + c[1].
	MSM	Tbilisi		21.5% (300)	
	MSM	Batumi		15.6% (168)	
	MSM	Kutaisi		9.6% (149)	
Dershem et al. (2009) (Oct, 2007)	PWID	GE (Kutaisi)	IBBS	1% (197)	EIA[4]+ WB c. (HIV BLOT[1])
Dershem et al. (2009) (Apr-May, 2009)	PWID	GE (Kutaisi)	IBBS	3.1% (195)	
Mirzazadeh et al. (2019) (2010)	MSM	GE	IBBS	6.2% (278)	ELISA + WB c.*
Ministry of Health and National Center for AIDS Prevention (2015) (2014)	Various populations:	AM	IBBS		EIA[4] + ICT[3] + c.[4]
	PWID	Yerevan		4% (300)	
	PWID	Gyumri		0% (50)	
	PWID	Vanadzor		3.8% (50)	
	FSW	Yerevan		0% (300)	

Table 1B (*Continued*)

Reference (Survey dates)	Population	Country (area/city)	Type of Survey	Prevalence % (n)	Assay (kit or type)
	FSW	Gyumri		0% (50)	
	FSW	Vanadzor		0% (50)	
	MSM	Yerevan		0.4% (300)	
	MSM	Gyumri		1.4% (50)	
	MSM	Vanadzor		1.9% (50)	
	Migrants	AM		0.4% (550)	
Johnston et al. (2014) (2010-2011)	PWID	AM (Yerevan)	CS	10.9% (270)	ELISA[24] + c. (EIA[4])
Weilandt et al. (2007)	Prisoners	AM	IBBS	2.4% (542)	ELISA*
Johnston (2016a) (2016)	Various populations:	AM	IBBS		ELISA[10] + WB c. (LAV Blot[1])
	PWID	Yerevan		0.5% (300)	
	PWID	Gyumri		0% (100)	
	PWID	Vanadzor		1.6% (100)	
	FSW	Yerevan		0.1% (300)	
	FSW	Gyumri		0.1% (100)	
	MSM	Yerevan		0.8% (300)	
	MSM	Gyumri		0.7% (100)	
	MSM	Vanadzor		0% (100)	
Johnston (2016b)	LM	AM	IBBS	0.2% (1840)	ELISA + WB c.*
Johnston (2018b)	LM	AM	IBBS	0.5% (300)	ELISA*
Johnston (2018a)	LM	AM	IBBS	1.2% (900)	ELISA[25] + ELISA[10] + WB c.
	LM	Yerevan		1.3% (300)	(LAV Blot[1])
	LM	Vanadzor		0.3% (300)	
Johnston (2018c) (2018)	Various populations:	AM	IBBS		ELISA[10] + WB c. (LAV Blot[1])
	PWID	Yerevan		2.2% (300)	
	PWID	Gyumri		0.5% (150)	
	PWID	Vanadzor		0.4% (150)	
	FSW	Yerevan		0.6% (300)	
	FSW	Gyumri		0% (150)	
	FSW	Vanadzor		0% (150)	
	MSM	Yerevan		2.7% (300)	
	MSM	Gyumri		1.3% (150)	
	MSM	Vanadzor		0.3% (150)	
	TG	Yerevan		2% (90)	

Among FSW and MSM the prevalence was between 6.7–17.8% (median 13%) and 0–18.9% (median 2.6%), respectively. One citation was found for migrants: 4.4% (n = 294) (Table 2B).

HBV prevalence

Central Asia

One citation was found for Kazakhstan, reporting HBV prevalence among PWID in Karaganda and Temirtau: 74.2% and 85.3%, respectively. One report each was found for Kyrgyzstan (6.2% prevalence in prisoners) and Tajikistan (5.3% in migrants) as shown in Table 3A. A search for Uzbekistan yielded one citation for migrants, reporting 4.1% prevalence (n = 464). Additionally, one citation on a mixed population of migrants from Tajikistan and Uzbekistan reported 15.7% prevalence.

Caucasus region

In Armenia, HBV prevalence was reported among MSM as 0–1.6% (median 0.3%) and migrants as 0.3–0.9% (median 0.6%). One report on prisoners noted a prevalence of 3.7% (n = 542) and one on transgender people showed 0% prevalence (n = 90). The Azerbaijan search yielded two eligible citations: one on prisoners and the other on PWID, with prevalence of 2.7% (n = 510) and 2.8% (n = 425), respectively. In Georgia, HBV prevalence was only measured among PWID (five surveys), ranging 2.8–55.2% (median 7%) (Table 3B).

Limitations

This review was limited by the (un)availability of quality data from reliable sources. For certain countries, such as Turkmenistan, almost no information was available. Similarly, certain high-risk populations, such as migrants and CSW, were inadequately studied in most of the study regions. Due to a high level of heterogeneity in the data encountered during this analysis, it was decided not to conduct a meta-analysis (Table 4).

Discussion

Central Asia and Caucasus region comprises eight geographically and economically connected countries with high migrant mobility (Table 5) (Alexandrov et al., 2012). Russia and Georgia, two major hubs for the Central Asian migrant populations, represent buffer zones for transmission. HIV prevalence in the region was highly variable, ranging 0–30.1%. Among 53 citations for HCV prevalence, reports ranged from 0 to 92.1%. Similarly, 11 citations for HBV suggested variable prevalence from 0 to 79.7%. The highest HIV prevalence (30.1%) was recorded among PWID in Kazakhstan. The same pattern was noted for HCV studies: >79% among PWID, mostly from cities in Kazakhstan, Georgia and Armenia. The highest HBV prevalence was noted among PWID in Kazakhstan in 2002.

Public health policies

The governments of Central Asian and Caucasian countries have approached the fight against HIV, HCV and HBV with varied fervor. On one hand, there is no available treatment for HIV in Turkmenistan, where two new HIV cases were last reported in 2007 (UNODC, 2010; Illiev et al., 1999). On the other hand, Georgia, where HCV prevalence reached 92% among PWID in 2012,

Table 2A
HCV prevalence in Central Asia.

Reference (Survey dates)	Population	Country (area/city)	Type of Survey	Prevalence % (n)	Assay (kit or type)
Deryabina and Kryukova (2014) (Jun-Aug, 2013)	SP PWID	KZ (Ust-Kamenogorsk, Pavlodar, Temirtau, Kostanai)	CS	25.8% (1125)	ELISA*
El-Bassel et al. (2014) (2009-2012)	FP PWID	KZ (Almaty)	CS	14.8% (135)	ELISA (AntiHCV[1])
	FWID	KZ (Almaty)	CS	89.8% (316)	
El-Bassel et al. (2011) (Jul-Oct, 2007)	Migrants	KZ (Almaty)	CS	0.7% (422)	ELISA (AntiHCV[1])
El-Bassel et al. (2013)	PWID and SP PWID	KZ (Almaty)	CS	75% (728)	ELISA (AntiHCV[1])
	PWID	KZ (Almaty)	CS	90.2% (580)	
Zhussupov et al. (2007) (May-Aug, 2002)	PWID	KZ	IBBS	79.8% (1787)	EIA*
	PWID	Temirtau		85.3% (899)	
	PWID	Karaganda		74.2% (888)	
Azbel et al. (2016) (Jul-Nov, 2014)	Prisoners	KG	IBBS	49.7% (368)	ELISA[14]
Mamaev (2007) (2005)	FSW	KG (Osh)	IBBS	5.5% (200)	EIA[8]
Chokmorova et al. (2013) (2013)	Various populations:	KG	IBBS		EIA*
	PWID	KG		45.2% (904)	
	FSW	KG		5% (855)	
	MSM	KG		2.2% (190)	
	Prisoners	KG		34.5% (750)	
Deryabina and Dooronbekova (2015) (Jun-Aug, 2013)	SP PWID	KG	IBBS	15.8% (857)	EIA*
Kadyrbekov et al. (2017) (Aug-Oct, 2016)	Various populations:	KG	IBBS		EIA*
	Prisoners	KG		42.8% (994)	
	PWID	KG		60.9% (1311)	
	MSM	KG		7.3% (640)	
	FSW	KG		3.3% (760)	
Beyrer et al. (2009) (May-Nov, 2004)	PWID	TJ (Dushanbe)	CS	61.3% (488)	ELISA (BIOELISA HCV)
Glikberg et al. (1997)	Bukharian Jews (migrants to Israel)	TJ and UZ	CS	26.5% (102)	ELISA[16] + c.[3]
AlSalih et al. (2017)	Migrants to Russia	TJ and UZ	CS		EIA[1]
	Migrants	UZ	CS	4.5% (464)	
	Migrants	TJ	CS	4.8% (415)	
Kurbanov et al. (2003) (Sep-Nov, 2001)	PWID	UZ	CS	51.7% (60)	PAT[4] + EIA[9]
Ruzibakiev et al. (2001) (1999-2000)	Various populations:	UZ	CS		PAT[4]
	PWID	UZ	CS	62.7% (51)	
	FSW	UZ	CS	9.2% (87)	
	MSM	UZ	CS	11.1% (9)	

implemented The Georgia HCV Elimination Program that aimed to reach a 90% reduction in HCV incidence by 2020 (Gvinjilia et al., 2016). Dictatorship in Turkmenistan had a hugely negative impact on public health policies in terms of diagnosing communicable disease, including HIV and TB. An unofficial ban on reporting the incidence of diseases, cuts in healthcare expenses and number of healthcare workers, apart from the problem of providing information in official languages, resulted in very limited or no access to data on diseases and their spread both for the general public and healthcare professionals (Rechel and McKee, 2007). Countries such as Kyrgyzstan heavily depend on international donors, who also appear to have a steering influence on the implementation of international guidelines, which were criticized to be inappropriately customized for the local needs (Ancker and Rechel, 2013). In contrast, Kazakhstan funds harm reduction activities, including provision of antiretroviral therapy (ART) to PWID, from the state budget and are less dependent on international sources (Ancker and Rechel, 2015). In general, near full dependence on international funding makes attempts of implementing HIV/AIDS programs in Uzbekistan, Tajikistan and Kyrgyzstan unsustainable in the long run (Ancker and Rechel, 2015).

Injection drug use

As expected, the PWID community exhibited the highest prevalence for all three viruses. Armenia had the lowest HIV prevalence among PWID: 0–10.9%. In 2005, Armenia legalized and launched opioid substitution therapy (OST) with methadone, and the program markedly expanded in 2009 (Lazarus et al., 2015). Armenia adopted a model of good practice, where medical and law enforcement institutions were able to establish a strong alliance for OST, decreasing illegal drug turnover and improving the supply of methadone to patients, even while incarcerated. The “Northern Route” of drug trafficking passes through all of the countries of Central Asia and Caucasus on the way to Russia, Ukraine and the rest of Europe. Renton et al. (2006) showed that in the areas (oblasts) on drug trafficking routes, migration rates of registered drug users and prevalence of HIV and syphilis are higher than in other administrative territories. OST programs in Central Asia have been deterred by major roadblocks. With the exception of oil-rich Kazakhstan, countries in this region rely on foreign funding (Ancker and Rechel, 2015). Uzbekistan is an example where OST has been discontinued (Ancker and Rechel, 2015). Sincere popular demand and political will are required to overcome resistance to implementing OST.

Sexual transmission

Men who have sex with men

The MSM community has been more extensively studied in Armenia and Georgia. In Turkmenistan and Uzbekistan, male-to-male sex is legally prohibited (Ancker and Rechel, 2015; ILGA-World, 2019). Georgia is the only country in the region that legally protects the LGBTQ (lesbian, gay, bisexual, transgender, and queer) population, while other countries are more neutral or hostile in terms of legal and policing policies (ILGA-World, 2019). Overall, in Central Asia and Caucasus, religious and social norms do not allow same-sex relationships, promoting the stigma against and marginalization of the homosexual population. In the current

Table 2B
HCV prevalence in Caucasus.

Reference (Survey dates)	Population	Country (area/city)	Type of Survey	Prevalence % (n)	Assay (kit or type)
Johnston (2019) (Feb-Mar, 2018)	Migrants	AM, GE, AZ	IBBS		ELISA*
	Migrants	AM	IBBS	0.7% (300)	
	Migrants	GE	IBBS	4.4% (294)	
Azbel et al. (2015) (Feb-May 2014)	Prisoners	AZ	IBBS	38.2% (510)	ELISA[26]
Mammadov et al. (2012)	PWID	AZ	CS	51.1% (425)	EIA[6]
Abdourakhmanov et al. (1998) (Apr, 1994 - Jun, 1996)	PWID	Daghestan	CS	82% (34)	ELISA[28]
Bouscaillou et al. (2014) (Oct, 2012)	PWID	GE (Tbilisi)	CS	92.1% (216)	ELISA[27]+PCR[1]
Kuniholm et al. (2008a) (Oct, 1997- Jun, 1998)	PWID	GE (Tbilisi, Batumi, Poti)	CS	58.2% (926)	ELISA[15]
Shapatava et al. (2006) (2000-2001)	PWID	GE	IBBS	68.8% (583)	ELISA[15]
Tsertsvadze et al. (2016)	PWID	GE	CS	0.28% (3600)	ELISA[15]
Chikovani et al. (2017)	PWID	GE	IBBS		ELISA[29]
	PWID	Tbilisi		74.1% (370)	
	PWID	Gori		66% (280)	
	PWID	Telavi		49% (280)	
	PWID	Zugdidi		51% (280)	
	PWID	Batumi		74.5% (280)	
	PWID	Kutaisi		65.2% (280)	
	PWID	Rustavi		50.2% (280)	
Chikovani et al. (2015) (Nov, 2014 - May, 2015)	PWID	GE	IBBS		EIA*
	PWID	Tbilisi		73.7% (357)	
	PWID	Gori		57.1% (287)	
	PWID	Telavi		41.6% (287)	
	PWID	Zugdidi		73.3% (286)	
	PWID	Batumi		79.8% (277)	
	PWID	Kutaisi		74.6% (284)	
	PWID	Rustavi		50% (246)	
Tsereteli et al. (2015b) (Feb-Apr, 2015)	MSM	GE (Tbilisi, Batumi)	IBBS		ELISA[14]
	MSM	Tbilisi		7% (300)	
	MSM	Batumi		18.9% (115)	
Tsereteli et al. (2017) (Mar-Apr, 2017)	FSW	GE (Tbilisi, Batumi)	IBBS		ELISA[14]
	FSW	Tbilisi		14.4% (195)	
	FSW	Batumi		6.7% (150)	
Tsereteli et al. (2014) (Mar-Apr, 2014)	FSW	GE	IBBS		ELISA[14] + WB c.
	FSW	Tbilisi		17.8% (157)	(HCV BLOT[1])
	FSW	Batumi		11.7% (120)	
Tsereteli et al. (2018) (Oct-Dec, 2018)	MSM	GE	IBBS		ELISA[30] + c[2].
	MSM	Tbilisi		2.6% (300)	
	MSM	Batumi		1.8% (172)	
	MSM	Kutaisi		0% (149)	
Dershem et al. (2009) (Oct, 2007)	PWID	GE (Kutaisi)	IBBS	57.8% (192)	ELISA[15] + WB c.
Dershem et al. (2009) (Apr-May, 2009)	PWID	GE (Kutaisi)	IBBS	71.3% (195)	(HCV BLOT[2])
Ministry of Health and National Center for AIDS Prevention (2015) (2014)	Various populations:	AM	IBBS		ELISA[31]
	PWID	Yerevan		52.6% (300)	
	PWID	Gyumri		14.1% (50)	
	PWID	Vanadzor		81.8% (50)	
	Migrants	AM		0.5% (550)	
Johnston et al. (2014) (2010-2011)	PWID	AM (Yerevan)	CS	36.6% (270)	ELISA[17]
Weilandt et al. (2007)	Prisoners	AM	IBBS	23.8% (542)	ELISA*
Johnston (2016a) (2016)	Various populations:	AM	IBBS		ELISA*
	PWID	Yerevan		30.7% (300)	
	PWID	Gyumri		8% (100)	
	PWID	Vanadzor		62.6% (100)	
Johnston (2016b)	LM	AM	IBBS	2.1% (1840)	ELISA*
Johnston (2018b)	LM	AM	IBBS	0.7% (100)	EIA*
Johnston (2018a)	LM	AM	IBBS	3.3% (900)	EIA*
	LM	Yerevan		3.4% (300)	
	LM	Vanadzor		3.6% (300)	
Johnston (2018c) (2018)	Various populations:	AM	IBBS		EIA*
	PWID	Yerevan		66.7% (300)	
	PWID	Gyumri		7.9% (150)	
	PWID	Vanadzor		80.3% (150)	

review, Georgia was found to have the highest (25.1%) reported HIV prevalence. This might be because homosexual behavior was more openly reported in this country and men were more willing to participate in the serosurveys, since LGBTQ minorities are protected by antidiscrimination laws in Georgia (RadioFreeEurope/RadioLiberty, 2014).

Sex workers

This review found that CSW were studied in Kyrgyzstan, Uzbekistan, Georgia, and Armenia, mostly for HIV prevalence, much less for HCV, and one citation was found for HBV prevalence in Uzbekistan. There is a need to more consistently conduct HCV and HBV prevalence studies among this population, to guide the

Table 3A
HBV prevalence in Central Asia.

Reference (Survey dates)	Population	Country (area/city)	Type of Survey	Prevalence % (n)	Assay (kit or type)
Zhussupov et al. (2007) (May-Aug, 2002)	PWID	KZ	IBBS	79.4% (1654)	EIA*
	PWID	Temirtau		79.2% (835)	
	PWID	Karaganda		79.7% (819)	
Azbel et al. (2016) (Jul-Nov, 2014)	Prisoners	KG	IBBS	6.2% (368)	ELISA[18]
Glikberg et al. (1997)	Bukharian Jews (migrants to Israel)	TJ and UZ	CS	15.7% (102)	EIA[16]
AlSalih et al. (2017)	Migrants to Russia	TJ and UZ	CS		EIA[1]
	Migrants	UZ	CS	4.1% (464)	
	Migrants	TJ	CS	5.3% (415)	
Ruzibakiev et al. (2001) (1999-2000)	Various populations:	UZ	CS		PAT[1]
	PWID	UZ	CS	35.3% (51)	
	FSW	UZ	CS	18.4% (87)	
	MSM	UZ	CS	22.2% (9)	

Table 3B
HBV prevalence in Caucasus.

Reference (Survey dates)	Population	Country (area/city)	Type of Survey	Prevalence % (n)	Assay (kit or type)
Johnston (2019) (Feb-Mar, 2018)	Migrants	AM	IBBS	0.9% (300)	ELISA*
Azbel et al. (2015) (Feb-May, 2014)	Prisoners	AZ	IBBS	2.7% (510)	ELISA[26]
Mammadov et al. (2012)	PWID	AZ	CS	2.8% (425)	EIA[7]
Bouscaillou et al. (2014) (Oct, 2012)	PWID	GE (Tbilisi)	CS	2.8% (216)	EIA[17]
Kuniholm et al. (2008a) (Oct, 1997- June, 1998)	PWID	GE (Tbilisi, Batumi, Poti)	CS	7.2% (926)	EIA[12]
Shapatava et al. (2006) (2000-2001)	PWID	GE	IBBS	55.2% (583)	EIA[15]
Dershem et al. (2009) (Oct, 2007)	PWID	GE (Kutaisi)	IBBS	7% (199)	ELISA[33]
Dershem et al. (2009) (Apr-May, 2009)	PWID	GE (Kutaisi)	IBBS	4.6% (194)	
Ministry of Health and National Center for AIDS Prevention (2015) (2014)	Various populations:	AM	IBBS		ELISA[32]
	MSM	Yerevan		1.1% (300)	
	MSM	Gyumri		1.4% (50)	
	MSM	Vanadzor		1.6% (50)	
	Migrants	AM		0.4% (550)	
Weilandt et al. (2007)	Prisoners	AM	IBBS	3.7% (542)	ELISA*
Johnston (2016a) (2016)	Various populations:	AM	IBBS		ELISA*
	MSM	Yerevan		0.3% (300)	
	MSM	Gyumri		1.6% (100)	
	MSM	Vanadzor		0% (100)	
Johnston (2016b)	LM	AM	IBBS	0.6% (1840)	ELISA*
Johnston (2018b)	LM	AM	IBBS	0.9% (300)	EIA*
Johnston (2018a)	LM	AM	IBBS	0.6% (900)	EIA*
	LM	Yerevan		0.7% (300)	
	LM	Gyumri		0.3% (300)	
	LM	Vanadzor		0.4% (300)	
Johnston (2018c) (2018)	Various populations:	AM	IBBS		ELISA*
	MSM	Yerevan		0.3% (300)	
	MSM	Gyumri		0.2% (150)	
	MSM	Vanadzor		0% (150)	
	TG	Yerevan		0% (90)	

harm reduction programs for these infections. The highest HIV prevalence in Central Asia was reported in Uzbekistan at 10% (Todd et al., 2006). In Uzbekistan, sex work is illegal and FSWs avoid using clinic services, for fear of getting arrested (Todd et al., 2007), exposing themselves to a higher risk of infection. Todd et al. (2007) reported that 70% of FSWs in Uzbekistan, due to clients' dislike, did not regularly use condoms. In Kyrgyzstan, HIV and HCV prevalence varied between 1.97–2.2% and 3.3–5.5%, respectively, among FSWs (Kadyrbekov et al., 2017; Chokmorova et al., 2013; Mamaev, 2007). No studies on HIV prevalence were found in Turkmenistan; however, it was reported that a high unemployment rate forces young women into the commercial sex trade. FSWs were reported to be at high risk of HIV and sexually transmitted infections (STI) due to: lack of knowledge regarding STI transmission, no access to free condoms, inconsistent condom use, prosecution by police, and low peer support (Chariyeva et al., 2011).

Incarcerated persons

Eligible citations on prisoners were found for Azerbaijan, Kyrgyzstan, Georgia, and Armenia. Two studies on prisoners in Kyrgyzstan and Azerbaijan (Azbel et al., 2015; Azbel et al., 2016) found that HIV, HCV and HBV prevalence was higher in Kyrgyzstan. It was reported that unofficial detentions aggravated the severity of drug addiction, hence raising the risk of HIV transmission (Polonsky et al., 2016). In Kyrgyzstan, for instance, 'within-prison drug injection' was also reported. There is a lack of published data on prisoners, even though in-prison testing is widely used in these countries, and PWID get detention on a regular basis in these countries. In Central Asia and Southern Caucasus, PLWH, PWID and FSW face discrimination and therefore risk incarceration (Ancker and Rechel, 2015). PWID comprise almost a third of the prisoner population in Azerbaijan and Kyrgyzstan (Polonsky et al., 2016). Police have been reported to intimidate, arrest or detain PWID

Table 4
HIV, HCV, HBV prevalence among general and other populations.

Reference (Survey dates)	Population	Country (area/city)	Type of Survey	Prevalence % (n)			Assay (kit or type)		
				HIV	HCV	HBV	HIV	HCV	HBV
Abdourakhmanov et al. (1998) (Apr, 1994 - Jun, 1996)	General population: a) BDs; b) Pts with chronic liver disease	Daghestan	CS		a) 0.93% (10,682); b) 43% (61)			ELISA[28]	
Kuzin et al. (2006) (1990-2004)	General population: a) PW; b) BDs; c) high school children	Kabardino-Balkaria	CS		a) 4.2% (315); b) 4.5% (110); c) 0% (382)	a) 3.4% (315); b) 3.6% (110); c) 2.9% (382)		EIA[18]	EIA[19]
Lvov et al. (1996) (1987-1993; 1993-1995)	General population	Northern Caucasus	CS		2.1% (819)			ELISA[2]; + c. (RIBA[2])	
Ibragimov et al. (2010)	BDs	AZ (Baku, Nakhchivan)	CS		3.8% (55589)	2.9% (55589)		ELISA[34]	ELISA[34]
Galetskii et al. (1999)	General population	AZ	CS	0% (835)	8.7% (835)	23.4% (835)	PAT[1]	PAT[2] + c. (PCR)	PAT[3]
Mamedov and Alieva (2012) (2007-2011)	PW	AZ (Baku)	CS		3.7% (1782)	2.6% (1782)		EIA*	EIA*
Mammadov et al. (2012)	Various populations:	AZ	CS					EIA[6]	EIA[7]
	HIV + ve people	AZ	CS		49% (1320)	1.3% (1320)			
	TB Pts	AZ	CS		12.2% (600)	9% (600)			
	General population	AZ	CS		4% (1541)	2.9% (1541)			
Sailov (1995) (Sep, 1990 - Jan, 1992)	Pts of somatic unit	AZ	CS			4.19% (20535)			EIA[20]
Sailov et al. (1999)	Various populations:	AZ (Baku)	CS					EIA[21]	EIA[22]
	VH Pts		CS		9.1% (650)	67.8% (650)			
	Pts with STD		CS		5.6% (280)	6.1% (280)			
	Pts with mental issues		CS		7.5% (120)	9.2% (120)			
	TB Pts		CS		7.5% (200)	13% (200)			
Vorozhbieva et al. (1985) (1978-1982)	General population	AZ	CS			2.8% (576)			PHA*
Badridze et al. (2008)	HIV + ve people	GE	CS		48.57% (175)	6.85% (175)	ELISA + WB c.	ELISA[15]	ELISA[35]
Butsashvili et al. (2012) (2006-2007)	HCWs	GE	CS	0% (1386)	5% (1386)	2% (1386)	ELISA[36]	ELISA[36] + RIBA	ELISA[3]+ c.
Butsashvili et al. (2001) (1998)	BDs	GE (Tbilisi)	CS	0% (4970)	7.3% (4970)	4.1% (4970)	ELISA[8], ELISA[34] + WB c. (HIV BLOT[1])	EIA[14]+ WB c. (HCV BLOT[2]), RIBA[1] + HCV PCR[2]	ELISA[23] + c. (EIA[15])
Butsashvili et al. (2008) (2002-2005)	PW	GE		0.001% (30330)			ELISA + WB c.*		
Chubinishvili et al. (1988) (May 1985 - May 1986)	a) BDs, b) PW	GE (Rustavi)	CS			a)6.4% (362), b) 2.5% (2356)			EIA[13]
Clifford et al. (2017)	general female population	GE (Tbilisi)	CS		1.2% (1431)			EIA*	
Kuniholm et al. (2008b) (Oct, 1997- Jun, 1998)	TB Pts	GE (Tbilisi, Batumi, Poti)	CS	0.7% (300)	12% (300)	4.3% (300)	EIA[2] + WB c. (DuPont[1])	ELISA[15]	EIA[12]
Lomtadze et al. (2013) (Mar, 2007 - Mar, 2010)	TB Pts	GE	CS	1.8% (326)	21% (326)	4.3% (326)	EIA[2] + WB c. (DuPont[1])	ELISA[15]	EIA[12]
Richards et al. (2006) (May-Jun, 2001)	TB Pts	GE	CS	1.1% (272)	22.4% (272)		ELISA + WB c.*	ELISA + RIBA + PCR*	
Sharvadze et al. (2008)	General population	GE (Tbilisi)	CS		6.9% (2000)			ELISA[15]+RIBA[1]	
Stvilia et al. (2006) (Oct, 2001 - Jun, 2002)	General population	GE (Tbilisi)	CS	0.15% (2000)	6.7% (2000)		ELISA[9]	ELISA[15]+ RIBA[1]	
Tsertsvadze et al. (2016)	BDs	GE	CS		0.09% (7600)			ELISA[15]	
Tsertsvadze et al. (2008) (2006)	PW	GE	CS	0.03% (42430)			ELISA[8] + WB c. (HIV BLOT 2.2)		

Table 4 (*Continued*)

Reference (Survey dates)	Population	Country (area/city)	Type of Survey	Prevalence % (n)			Assay (kit or type)		
				HIV	HCV	HBV	HIV	HCV	HBV
Iarasheva et al. (1991) (Jan-Dec, 1990)	VH Pts	TJ (Dushanbe)	CS			22.8% (1562)			EIA[1]
Vorozhbieva et al. (1985) (1978-1982)	General population	TJ	CS			7.2% (708)			PHA*
Iashina et al. (1993)	General population	TJ	CS		3.9% (284)			ELISA[21]	
Iashina et al. (1993)	General population	TM	CS		5.3% (391)				
Iashina et al. (1993)	General population	Kyrgyzstan	CS		2.9% (588)				
Karabaev et al. (2017) (Jan, 2013 - Dec, 2015)	BDs	Kyrgyzstan (Bishkek)	CS	0.78% (37165)	3.1% (37165)	3.6% (37165)	EIA[1]	EIA[1]	EIA[1]
Kruglov et al. (1995)	General population	KZ (ZKO)	CS		1.7% (579)	5.5% (579)		EIA[1]	EIA[1]
Nurgalieva et al. (2007)	General population	KZ (Almaty)	CS		3.2% (290)	3.8% (290)		ELISA[15]	EIA[12]
Skorikova et al. (2015) (2012)	BDs	KZ (Astana)	CS	0.06% (17612)	1.2% (17612)	2.2% (17612)	ELISA[6]+ c. (EIA[4])	EIA[10] + c. (ELISA[19])	EIA [11]+ c. (ELISA[20])
Nersesov et al. (2016)	General population	KZ (YKO)	CS		4.6% (1401)	3.4% (1401)		EIA*	EIA*
Kurbanov et al. (2003) (Sep-Nov, 2001)	Various populations:	UZ	CS					PAT[4] + EIA[9]	
	General population		CS		6.5% (341)				
	VH + TB Pts		CS		27.1% (868)				
Kuzin et al. (1990)	PW	UZ (Karshi, Fergana)	CS			6.9% (6142)			PHA*
	children of HBV-infected women	UZ (Karshi, Fergana)	CS			40% (50)			
Mikhailov et al. (1985)	General population	UZ (Tashkent)	CS			3.1% (1914)			PHA*
Ruzibakiev et al. (2001) (1999-2000)	Various populations:	UZ	CS				PAT[1]	PAT[4]	PAT[1]
	General population	UZ	CS	0% (929)	13.1% (929)	13.3% (929)			
	BDs	UZ	CS	0% (346)	6.4% (346)	5.2% (346)			
	HCWs	UZ	CS	0% (40)	12.5% (40)	30% (40)			
	HIV + ve people	UZ	CS	100% (39)	53.8% (39)	7.7% (39)			
	VH Pts	UZ	CS	0% (96)	16.6% (96)	41.7% (96)			
	Pt with chronic liver disease	UZ	CS	0% (164)	26.8% (164)	25.6% (164)			
	Pt with hematological disease	UZ	CS	0% (72)	29.2% (72)	18.1% (72)			
	Pt with renal disease	UZ	CS	0% (85)	16.5% (85)	15.3% (85)			

Table 5
Demographics of the countries of Central Asia and Caucasus. Country abbreviations are the same as those used for Tables 1A-4. In Age Structure, percentages refer to proportion of a certain age group (in years) in total population, while the numbers refer to male (M) and female (F) populations in million.

Country	Population (Million) (115)	Age Structure (Demographics Profile, 2020) (Million)	Ethnic/Religious mix (116)	GDP per capita in 2017 (117)	ART availability (118)
Central Asia					
KZ	18.7	0-14: 26.13% (M 2.4/F 2.5) 15-24: 12.97% (M 1.3/F 1.2) 25-54: 42.23% (M 3.9/F 4.1) 55-64: 10.25% (M 0.8/F 1.1) 65+: 8.43% (M 0.5/F 1.0)	Kazakh 68%, Russian 19.3%, Uzbek 3.2%, Ukrainian 1.5%, Uighur 1.5%, Tatar 1.1%, German 1%, other 4.4% Muslim 70.2%, Christian 26.2%, other 0.2%, atheist 2.8%, unspecified 0.5%	$26,300	Available since 2009; currently through the Government
KG	6.5	0-14: 30.39% (M 0.9/F 0.8) 15-24: 15.7% (M 0.5/F 0.5) 25-54: 40.02% (M 1.1/F 1.2) 55-64: 8.09% (M 0.2/F 0.3) 65+: 5.8% (M 0.1/F 0.2)	Kyrgyz 73.5%, Uzbek 14.7%, Russian 5.5%, Dungan 1.1%, other 5.2% Muslim 90%, Christian 7%, other 3%	$3,700	Available through the Global fund
TJ	9.5	0-14: 31.43% (M 1.4/F 1.3) 15-24: 18.13% (M 0.8/F 0.8) 25-54: 40.58% (M 1.8/F 1.8) 55-64: 6.23% (M 0.2/F 0.3) 65+: 3.63% (M 0.1/F 0.2)	Tajik 84.3%, Uzbek 13.8%, other 2% Muslim 98% other 2%	$3,200	Available for free and funded by donors
TM	6.0	0-14: 25.44% (M 0.7/F 0.7) 15-24: 16.48% (M 0.4/F 0.4) 25-54: 44.14% (M 1.2/F 1.2) 55-64: 8.56% (M 0.2/F 0.2) 65+: 5.38% (M 0.1/F 0.1)	Turkmen 85%, Uzbek 5%, Russian 4%, other 6% Muslim 89%, Eastern Orthodox 9%, unknown 2%	$18,200	No data available
UZ	33.4	0-14: 23.19% (M 3.6/F 3.4) 15-24: 16.63% (M 2.6/F 2.5) 25-54: 45.68% (M 6.9/F 7.0) 55-64: 8.63% (M 1.2/F 1.4) 65+: 5.87% (M 0.7/F 1.0)	Uzbek 83.8%, Tajik 4.8%, Kazakh 2.5%, Russian 2.3%, Karakalpak 2.2%, Tatar 1.5%, other 4.4% Muslim 88%, Eastern Orthodox 9%, other 3%	$6,900	Available for free, but funding is not independent
Caucasus					
AM	2.9	0-14: 18.64% (M 0.3/F 0.2) 15-24: 11.63% (M 0.2/F 0.1) 25-54: 43.04% (M 0.6/F 0.6) 55-64: 14.08% (M 0.2/F 0.2) 65+: 12.6% (M 0.1/F 0.2)	Armenian 98.1%, Yezidi (Kurd) 1.2%, other 0.7% Armenian Apostolic 92.6%, Evangelical 1%, other 2.4%, none 1.1%, unspecified 2.9%	$9,500	Available since 2005
AZ	10.1	0-14: 22.84% (M 1.2/F 1.1) 15-24: 13.17% (M 0.7/F 0.6) 25-54: 45.29% (M 2.3/F 2.3) 55-64: 11.41% (M 0.5/F 0.6) 65+: 7.29% (M 0.3/F 0.4)	Azerbaijani 91.6%, Lezghin 2%, Russian 1.3%, Armenian 1.3%, Talysh 1.3%, other 2.4% Muslim 96.9%, Christian 3%, other <0.1	$17,500	Available since 2006

Table 5 (*Continued*)

Country	Population (Million) (115)	Age Structure (Demographics Profile, 2020) (Million)	Ethnic/Religious mix (116)	GDP per capita in 2017 (117)	ART availability (118)
GE	3.9	0-14: 18.42% (M 0.4/F 0.4) 15-24: 10.9% (M 0.3/F 0.2) 25-54: 40.59% (M 0.9/F 1.0) 55-64: 13.24% (M 0.3/F 0.3) 65+: 16.85% (M 0.3/F 0.5)	Georgian 86.8%, Azeri 6.3%, Armenian 4.5%, other 2.3% Orthodox 83.4%, Muslim 10.7%, Armenian Apostolic 2.9%, other 1.2%, none 0.5%, unspecified 1.2%	$10,700	Available universally since 2004

without formal charges (Polonsky et al., 2016). Such detentions often result in interruption of ART and/or OST therapy, thus aggravating the addiction. Following the model in Armenia, it is recommended that rather than using intimidation and arrest to discourage drug use, PWID should be directed toward treatment and harm reduction.

Migration

In Central Asia and Caucasus–as a result of frequent travel, trade and risk exposures–migrant populations are considered at high-risk for transmitting infections (DeHovitz et al., 2014). The highest HIV prevalence of 1.2% in the biggest sample (n = 900) was reported for Armenian migrants (Johnston, 2018a). Armenian migrants are mostly males going to Russia for seasonal work. They tend to have limited HIV knowledge and engage in sexual contact with CSW involving irregular use of condoms (Johnston, 2018a; Agadjanian and Markosyan, 2017). As the prevalence appears to be growing, this population needs urgent attention. Although high migrant mobility is a general phenomenon in Central Asia and Caucasus (Ryazantsev, 2016), eligible citations in this population were sparse. This is a clear indication that there is a need to conduct regional studies on migrant populations. A promising model is the Transit to Russia AIDS Intervention with Newcomers (TRAIN) project, in which migrants are approached on the train travelling from Tajikistan to Moscow, which is a 4-day trip that gives the participants adequate time to be interviewed and educated about risks and prevention of transmission risk factors (Bahromov and Weine, 2011). When the participants were contacted 3 months later, they reported more frequent condom use, both with sex and non-sex workers, and more frequent talking with their partners, including wives, about HIV/AIDS (Bahromov and Weine, 2011). Such efforts can be effective in spreading awareness, which can protect migrants themselves, their sex partners and spouses.

Limitations

The study was limited by the availability of good quality data. For certain countries, such as Turkmenistan, the data for this review were especially sparse. The same is true for studies on certain high-risk groups, such as migrants and CSWs, that have not been adequately surveyed in the studied region.

Conclusions

The quality and number of published prevalence reports for the key populations have significantly improved within the last 15 years. Regularly published IBBS reports are readily available for Georgia and Armenia; however, comparatively much less data are available for Central Asian countries. Countries of Central Asia and Caucasus are closely interlinked through culture, trade and cross-border migration (Table 5). These overlaps present opportunities to create platforms for communication and sharing experiences regarding control and prevention strategies against HIV, HCV and HBV. What has worked in some countries should be considered and adapted by others in the region. The TRAIN initiative (Bahromov and Weine, 2011), for instance, is an attractive model for raising awareness among labor migrants–a significant high-risk population unique to this part of the world. Efficient collaboration of medical and law enforcement institutions in Armenia, and effective HIV/HCV control programs in Georgia are also excellent examples that may be adapted by other countries in the region.

Funding

Funded, in part, by National Institutes of Health grants #P30MH062294 (SHV) and #R03DA052179 (SHV and SHA), and by Nazarbayev University#110119FD4516 (SHA).

Ethical Approval

None.

Conflict of Interest

None.

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.ijid.2020.12.068.

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