Chapter 1

Emergence of New Epidemiological Hepatitis B and C Profiles in High Risk Groups in Latin America

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Abstract

Latin America includes Mexico, the islands of the Caribbean and Central and South America, which possess a rich cultural and natural heritage. A narrative literature review was made to determine epidemiological hepatitis B and C profiles in high risk groups in Latin America, such as, drug users, hemophiliacs, and chronic kidney disease (CKD), human immunodeficiency virus (HIV) infected individuals. Using data from international databases that disseminate published quality studies. All studies with desired information regarding site and study population were included. It was observed that HBV prevalence diminished in several groups, probably due to implementation of HBV vaccination in various Latin America Countries (LACs). On the other hand, HCV prevalence is high among high risk groups compared to general population, but different values were observed in LAC, probably due to different access to education programs, assays evaluated, population size and type of recruitment. Due to chronicity of HBV and HCV, it is important to increase access to diagnosis, HBV vaccination and implementation of education programs to high risk groups to diminish burden of these infections.

Keywords: HBV, HCV, prevalence, HIV, chronic kidney disease, coagulopathy, illicit substance abuse

1. Introduction

The Latin American and Caribbean region encloses the Spanish, Portuguese and French-speaking countries of the American continent and covers almost 22,000,000 km^2. It includes

Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, El Salvador, Ecuador, Guatemala, Haiti, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Dominican Republic, Uruguay and Venezuela, which possess a rich cultural and natural heritage [1].

Clinical manifestation of hepatitis B and C virus infection varies in both acute and chronic disease. HBV acute phase could be subclinical or anicteric hepatitis to icteric hepatitis and in some cases fulminant hepatitis. Acute Hepatitis C is often asymptomatic and leads to chronic infection in about 75% of cases. During the chronic phase, manifestations range from an asymptomatic carrier state to chronic hepatitis, cirrhosis, and hepatocellular carcinoma. Extrahepatic manifestations can occur in both acute and chronic infection. Pathophysiology is based on the inflammatory response to the virus that replicates in the hepatocyte [2–4].

Viral hepatitis is an important public health issue over the world, but there is still some gaps regarding the prevalence of these viruses in Latin America. Hepatitis B virus (HBV) infection has a heterogeneous distribution in Latin America and it is estimated at least 7–12 million people infected by virus [5]. Most of Latin American countries presented low seroprevalence (less than 2% of HBsAg positivity), including Mexico, Honduras, Nicaragua, Costa Rica, Panama, Cuba, Paraguay, Uruguay, Chile, Argentina, Peru and North Colombia. Intermediate seroprevalence (2.0–8.0% of HBsAg) are observed in Central America (Guatemala, Belize, El Salvador, Honduras, Haiti the Dominican Republic and Puerto Rico), Ecuador, Venezuela, Guyana, Surinam, French Guyana and South of Brazil. High seroprevalence (>8% of HBsAg presence) are observed in Peru, South Colombia, Northern Bolivia and Northern Brazil; however, these reports are primarily estimates [6–9].

Hepatitis C virus (HCV) infection prevalence varies from 1.2 to 1.6% in Peru, Mexico, Venezuela, Argentina and Brazil where almost 80% were viremic [9]. According the same study, genotype 1 was the most frequent detected, but genotype 1b was the most prevalent in all countries except in Peru where genotype 1a was the highest prevalent. Díez-Padrisa et al. [7] reported that Grenada, Bolivia, Haiti, Trinidad and Tobago and El Salvador have the highest prevalence (≥2.5%) in Latin America.

Epidemiological studies to determine HBV and HCV prevalence are important, principally among high risk population, such as human immunodeficiency virus (HIV) infected subjects, drug users, hemophiliacs and chronic kidney patients. HIV individuals coinfected with HBV or HCV could present clinical complications of liver disease and increased risk of developing cirrhosis. Individuals who are drug and alcohol abusers are at risk of becoming infected with HBV or HCV due to unprotected sexual practices that are common to these users besides the sharing of needles and syringes [10]. Chronic kidney disease (CKD) and coagulopathy patients are often exposed to blood, such as during hemodialysis or blood components transfusion where the risk of contracting viral infections is also very high [11].

Knowing the scenario of HBV and HCV infection in Latin American countries (LAC) is important to raise awareness among the population and health professionals, strengthening preventive measures mainly among the high-risk population, increasing access to diagnosis, improving the attendance of the diagnosed cases, treatment and monitoring [7]. In this chapter, a narrative literature review was undertaken to give information for developing policies

and evidence-based care. This type of review gives comprehensive background for understanding current knowledge and highlighting the significance of new research in this area.

2. Methodology

A narrative review of the literature was done using SCIELO, LILACS and MEDLINE® database searches in an iterative manner during December to April 2018 to retrieve articles related to current and historical epidemiological profile of hepatitis B and C in the countries of Latin America and the Caribbean.

Search terms included "hepatitis B," "hepatitis C," "HIV," "illicit substance," "drug user", "CKD", "dialysis", "coagulopathy", "prevalence", "epidemiology", "Latin America". The reference lists of each article found were also reviewed in detail to find additional articles.

All authors independently read each article in full text, evaluated the relevance and quality of retrieved articles to include the data, and recorded the main findings of each study to include the relevant articles in **Table 1**. Primary and secondary studies were included in the review, but duplicate studies were removed.

3. Results and discussion

3.1. Hepatitis B and C prevalence in patients infected by HIV

HIV infection can increase clinical complications of liver disease associated to HBV and HCV, such as increasing the risk of developing cirrhosis up to five times in those co-infected with HIV/HCV [12]. With antiretroviral therapy and a significant increase in the life expectancy of people living with HIV, liver disease in patients with HCV and/or HBV infection has become the leading cause of non-AIDS-related deaths in this population.

In Latin America and the Caribbean, the prevalence of HBV and HCV in people living with HIV is quite variable. Moreover, few data are available, unlike data for Europe and the United States [12]. Over the world, 10% of people infected with HIV are also coinfected with HBV [13], since both viruses has the parenteral and sexual pathways as a route of infection, coinfection of these two viruses are common [14].

According Tengan et al. [15], estimated prevalence of HBsAg in LAC ranged from 2.0% (95% CI 1.0–5.0%) to 15.0% (95% CI 9.0–24.0%) and pooled prevalence was 7.0% (95% CI 7.0–7.0%). They also observed a drop in HBsAg prevalence from 8.0% (95% CI 8.0–9.0%) in the 12 studies published from 1999 to 2006 to 6.0% (95% CI 5.0–6.0%) in 16 studies published from 2007 to 2016. The decrease in HBsAg prevalence could be related to implementation of vaccination against hepatitis B.

In Brazil, HBsAg prevalence in HIV infected individuals ranges from 1.9 to 10.3% according geographical regions [15–18]. Tengan et al. [15] reported HBsAg prevalence in HIV of 3.3% in

Authors	Country	Year study	Type of study	Methodology	Key findings	Comments, if any
Alonso et al. [38]	Latin America and Caribe	2015	Secondary study/ analyze database/ systematic review	53 studies included both genders	Injecting drug users, HBV, HCV, Latin America and prevalence	
Degenhardt et al. [28]	Latin America and	2017	Secondary study/ analyze database/ systematic review	976 studies/individuals 15–64 years, both genders	Injecting drug users, HBV, HCV, Latin America and prevalence	Global study
Bautista-Amorocho et al. [14]	Colombia	2014	Primary study	275 individuals, 2009–2010, both genders s	HIV, HBV, HCV, Latin America and prevalence	
Mejia et al. [50]	Colombia	2004	Conference	No information	Injecting drug users, HBV, Latin America and prevalence	Summaries of a conference
Weissenbacher et al. [45]	Argentina	2003	Primary study	174 individuals, average of 30 years and both genders	Injecting drug users, HBV, HCV, Latin America and prevalence	
Sheehan et al. [40]	Argentina	2012	Primary study	205 individuals, age 18–65 years, 2005–2006 and both genders	Injecting drug users, HBV, HCV, Latin America and prevalence	
Caiaffa et al. [46]	Brazil	2006	Primary study	1144 individuals, 1998–2001 and both genders	Injecting drug users, HBV, HCV, Latin America and prevalence	
Osimani et al. [43]	Uruguay	2003	Secondary study/ analyze database/ systematic review	367 individuals, both genders and aging over 18 years	Users of illicit drugs, HBV, HCV, Latin America and prevalence	
Monsalvand Castillo et al. [51]	Venezuela	2007	Primary study	197 individuals of both genders	Risk population, HBV, HCV, Latin America and prevalence	
Reyes et al. [47]	Porto Rico	2006	Primary study	400 individuals of both genders	Injecting drug users, HBV, HCV, Latin America and prevalence	
Lopes et al. [53]	Brazil	2009	Primary study	691 individuals, both genders and 2005–2006	Injecting drug users, HBV, HCV, Latin America and prevalence	Drug-treatment centers

Authors	Country	Year study	Type of study	Methodology	Key findings	Comments, if any
Germano et al. [42]	Brazil	2010	Primary study	750 individuals and both genders,	Risk population, HBV, HCV, Latin America and prevalence	Voluntary Counseling and Testing Center
Oliveira et al. [30]	Brazil	1999	Primary study	102 individuals and both genders	Users of illicit drugs, HBV, HCV, Latin America and prevalence	
Oliveira-Filho et al. [41]	Brazil	2013	Primary study	384 individuals and both genders	Risk population, of illicit drugs, HBV, HCV, Latin America and prevalence	
Pazeto et al. [30]	Brazil	2012	Primary study	Individuals and both genders	Risk population, HBV, HCV, Latin America and prevalence	Alcoholic individuals
Cortês et al. [37]	Brazil	2013	Primary study	90 individuals and both genders	Risk population, HBV, HCV, Latin America and prevalence	Alcoholic individuals
Santos-Cruz et al. [36]	Brazil	2013	Primary study	160 individuals, ages 18–24, both genders from 2010 to 2011	Users of illicit drugs, HBV, HCV, Latin America and prevalence	
Ferreira et al. [79]	Brazil	2009	Primary study	1095 individuals and both genders	Hemodialysis, HBV, HCV, Latin America and prevalence	Dialysis units
Marchesini et al. [32]	Brazil	2007	Primary study	205 individuals and both genders	Users of illicit drugs, HBV, HCV, Latin America and prevalence	Public health clinics.
Matos et al. [33]	Brazil	2013	Primary study	149 individuals and both genders	Users of illicit drugs, HBV, HCV, Latin America and prevalence	
Novaes et al. [32]	Brazil	2009	Primary study, transversal	314 individuals and male gender	Users of illicit drugs, HBV, HCV, Latin America and prevalence	
Andrade et al. [29]	Brazil	2017	Primary study, transversal	66 individuals, 28.4 years and most were male	Users of illicit drugs, HBV, HCV, Latin America and prevalence	
Frost et al. [48]	Mexico	2006	Primary study	200 individuals and year of 2005	Users of illicit drugs, HBV, HCV, Latin America and prevalence	
Valtuille et al. [61]	Argentina	2002	Primary study	1994–2000	Hemodialysis, chronic kidney disease, HBV, HCV, Latin America and prevalence	Spread in hemodialysis

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Authors	Country	Year study	Type of study	Methodology	Key findings	Comments, if any
Marinovich et al. [62]	Argentina	2012	Primary study	13,466 with mean age of 60.4 years	Hemodialysis, chronic kidney disease, HBV, HCV, Latin America and prevalence	Spread in hemodialysis
Méndez-Chacon et al. [59]	Peru	2005	Primary study	128 patients and year of 2000	Hemodialysis, chronic kidney disease, HBV, HCV, Latin America and prevalence	Spread in hemodialysis
Pujol et al. [60]	Venezuela	1996	Primary study	227 patients	Hemodialysis, chronic kidney disease, HBV, HCV, Latin America and prevalence	spread in hemodialysis
Gonzalez et al. [65]	Chile	2000	Primary study	Year of 1995	Hemodialysis, chronic kidney disease, HBV, HCV, Latin America and prevalence	Spread in hemodialysis
Santana et al. [65]	Cuba	2009	Multi-center analysis	Year of 1995	Hemodialysis, chronic kidney disease, HBV, HCV, Latin America and prevalence	Spread in hemodialysis
Cabezas et al. [67]	Cuba	2010	Primary study	Year of 1995	Hemodialysis, chronic kidney disease, HBV, HCV, Latin America and prevalence and prevalence	Spread in hemodialysis
López et al. [59]	Uruguay	2005	Cross-sectional study	409 patients	Hemodialysis, chronic kidney disease, HBV, HCV, Latin America and prevalence	Multi-transfused patients
González Michaca et al. [68]	Uruguay	2000	Cross-sectional study	235 patients	Hemodialysis, chronic kidney disease, HBV, HCV, Latin America and prevalence	Spread in hemodialysis
Méndez-Sanchez et al. [69]	Mexico	2004	Primary study	149 patients	Hemodialysis, chronic kidney disease, HBV, HCV, Latin America and prevalence	Spread in hemodialysis
Paniagua et al. [77]	Mexico	2010	Primary study, cross-sectional study	368 patients and mean age of 52 years	Hemodialysis, chronic kidney disease, HBV, HCV, Latin America and prevalence	Spread in hemodialysis

Authors	Country	Year study	Type of study	Methodology	Key findings	Comments, if any
Oliveira-Penido et al. [75]	Mexico	2008	Primary study	884 patients, between 41 and 60 years old and the majority male	Hemodialysis, chronic kidney disease, HBV, HCV, Latin America and prevalence	Spread in hemodialysis
Leão et al. [76]	Brazil	2010	Primary study, cross-sectional study	236 patients and year of 1995	Hemodialysis, chronic kidney disease, HBV, HCV, Latin America and prevalence	Spread in hemodialysis
Guimarães et al. [78]	Brazil	2017	Primary study, cross-sectional study	181 patients and the majority male	Hemodialysis, chronic kidney disease, HBV, HCV, Latin America and prevalence	Spread in hemodialysis
de Jesus et al. [74]	Brazil	2013	Primary study	798 patients	Hemodialysis, chronic kidney disease, HBV, HCV, Latin America and prevalence	Spread in hemodialysis
Ribeiro Barbosa et al. [17]	Brazil	2017	Primary study, cross-sectional study	798 patients	Hemodialysis, chronic kidney disease, HBV, HCV, Latin America and prevalence	Spread in hemodialysis
Callegaro et al. [72]	Brazil	2006	Primary study	798 patients and year of 2000–2002	Hemodialysis, chronic kidney disease, HBV, HCV, Latin America and prevalence	Spread in hemodialysis
Carrilho et al. [80]	Brazil	2004	Primary study	813 patients, 149 hemodialysis workers and 772 healthy controls	Hemodialysis, chronic kidney disease, HBV, HCV, Latin America and prevalence	Spread in hemodialysis
Ferreira et al. [81]	Brazil	2006	Primary study	1095 patients	Hemodialysis, chronic kidney disease, HBV, HCV, Latin America and prevalence	Spread in hemodialysis
Tengan et al. [12]	Latin American countries	2016	Systematic review	37 studies	HIV, HBV, HCV, Latin America and prevalence	People living with HIV/AIDS
Greer et al. [19]	Brazil	2017	Primary study	1241 HIV positive and 1232 HIV negative subjects	HIV, HBV, HCV, Latin America and prevalence	
Flores et al. [16]	Brazil	2017	Primary study, cross-sectional study	409 individuals	HIV, HBV, HCV, Latin America and prevalence	HCV+ our HBV+ individuals

Authors	Country	Year study	Type of study	Methodology	Key findings	Comments, if any
Toscano and Corrêa [18]	Brazil	2017	Primary study	2242 individuals	HIV, HBV, HCV, Latin America and prevalence	People living with HIV/AIDS
Oliveira et al. [21]	Brazil	2016	Primary study	505 individuals	HIV, HBV, HCV, Latin America and prevalence	
Freitas et al. [24]	Brazil	2004	Primary study	848 individuals	HIV, HBV, HCV, Latin America and prevalence	People living with HIV/AIDS
Brandão et al. [25]	Brazil	2015	Primary study	495 individuals	HIV, HBV, HCV, Latin America and prevalence	People living with HIV/AIDS
Tizzot et al. [26]	Brazil	2016	Primary study	303 individuals and mean age 41.2 years	HIV, HBV, HCV, Latin America and prevalence	People living with HIV/AIDS
Bautista-Amorocho et al. [20]	Colombia	2014	Primary study	275 individuals and year of 2009–2010	HIV, HBV, HCV, Latin America and prevalence	People living with HIV/AIDS
Quarleri et al. [22]	Argentina	2007	Primary study	593 individuals	HIV, HBV, HCV, Latin America and prevalence	People living with HIV/AIDS
Ballester et al. [95]	Cuba	2005	Primary study	318 individuals	Hemophilia, HBV, HCV, Latin America and prevalence	Multi-transfused patients
Beltrân et al. [71]	Colombia	2005	Primary study	500 individuals	Hemophilia, HBV, HCV, Latin America and prevalence	**Groups:** hemophilia, hemodialysis, acute bleeding, ontological illnesses and sickle cell disease or thalassemia
Laguna-Torres et al. [97]	Peru	2005	Cross-sectional multi-center study	351 patients and year of 2003–2004	Hemophilia, HBV, HCV, Latin America and prevalence	Multi-transfused patients
Vinelli and Lorenzana [94]	Honduras	2005	Cross-sectional study	502 patients and year of 2002–2005	Hemophilia, HBV, HCV, Latin America and prevalence	Multi-transfused patients
Remesar et al. [100]	Argentina	2005	Multi-center, cross-sectional study	504 patients	Hemophilia, HBV, HCV, Latin America and prevalence	Multi-transfused patients
Ferreira et al. [98]	Brazil	2014	Secondary study, analyze database	9122 patients	Hemophilia, HBV, HCV, Latin America and prevalence	Patients with hemophilia A

Table 1. Main characteristics of studies included in the review according country and type of individuals.

Colombia, 3.1% in Venezuela, 6.1–8.5% in Chile, 3.3–14.5% in Argentina, 5.1–10.3% in Cuba. Occult hepatitis B infection (OBI) has been reported in 3.8% of HIV infected individuals from Central West region in Brazil and 12% of Colombian HIV people [20, 21]. HBV genotype A was the most detected in studies from Brazil and Argentina while genotype F was most found in Colombia [17, 19–22].

All over the world, HIV/HCV coinfection is reported in 4% of HIV-infected people and probability of HCV infection is six times higher in people living with HIV than in the general population [23]. Recently, a systematic review reported prevalence of HIV/HCV co-infection in Latin America of 8% varying from 5 to almost 50% according countries [23]. In LAC, the estimated seroprevalence of HCV infection varied from 0.8 to 58.5% (mean 17.37; median 10.91), with the highest in Argentina (58.5%) and Brazil (53.5%) and the lowest in Venezuela (0.7%) and Colombia (0.8%) [12].

The differences in HCV prevalence observed in LAC were probably due to difference in assays used and characteristics of the population included. In addition, it was observed that HCV prevalence is higher in HIV infected individuals compared to general population in Latin America countries [12].

Recent studies found anti-HCV prevalence in HIV infected individuals of 1.3% in Northeast Brazil, 4.6% in Southeast Brazil, 12.9% in South Brazil, 6.9–9.7% in Midwest Brazil [16, 17, 24–26]. In all of these studies, HCV genotype 1 was the most prevalent.

This high rate of coinfection among these viruses is probably due to the common transmission of these infections, especially among high risk individuals, such as injecting drug users (IDU) living with HIV. Health preventive measures for reducing HBV and HCV infection in these individuals could reduce the prevalence of hepatitis viruses in Latin America region.

3.2. HBV and HCV infection in illicit substance users

According to United Nations Office on Drugs and Crime (UNODC) [27], around 5% of the global adult population used illicit substance at least once in 2015 and 0.6% of global adult population suffer from drug use disorders [27]. The consumption of psychoactive substances is related to risks and damages of great social magnitude: unprotected sexual practices, sharing of syringes and needles, as well as exposure to sexually transmitted and parenteral infections, such as HBV [10]. Worldwide prevalence of HBV infection among injecting drug users (IDU) is estimated at 7.4%, suggesting that 880,000 IDU are infected with HBV [27].

In Latin America, the most consumed illicit substance by individuals at drug treatment is Cannabis (around 45%), followed by Cocaine (almost 40%). Recent systematic review demonstrated that HBsAg prevalence varies from 2 to 10% among people who inject drug (PWID) in Latin America countries [28]. In this review, studies published from 2011 to 2017 were included and most of PWID were young (aging less than 25 years), had history of arrest and incarceration, and use opioid.

Most of prevalence studies of HBV in illicit substance users (ISU) in Latin America were conducted in Brazil, followed by Argentina, Colombia, Mexico and Uruguay. In Northern Brazil,

HBV prevalence (anti-HBc positivity) was 36.7% in ISU, genotypes A, D and F were found and risk factors were: (i) male gender, (ii) age above 35 years, (iii) anti-HIV positivity, (iv) tattoos, (v) the use of injected drugs, (vi) the use of illicit drugs for more than 3 years, (vii) sexual relations without protection, (viii) sexual relations with another DU, and (ix) more than 10 sexual partners in the past 24 months [29]. In Southeast Brazil, anti-HBc prevalence around 55% was found among IDU in 1999 and IDU living with HIV in 2007. It is important to observe that HBsAg prevalence drops from 7.8 to 3.4% in this region what could be the result of vaccination campaigns [30–32]. Occult HBV infection (OBI) of 12.7% was also documented in IDU from Central West region of Brazil demonstrating a high prevalence of OBI in this population [33].

Among non-injecting drug users (NIDU) (crack, alcohol, marijuana, cocaine), HBsAg prevalence varies from 0.1 to 6.2% according geographical regions in Brazil showing a low risk in this group compared to IDU [34–37].

HCV prevalence varies among ISU in Latin America. Degenhardt et al. [28] estimates prevalences less than 40% and higher than 80% among IDU in Latin America. A recent review included studies from 2000 to 2013 conducted in Argentina, Brazil, Colombia, Dominican Republic, Mexico, Panama, Peru, Puerto Rico, Uruguay and Venezuela [38]. Anti-HCV prevalence in ISU was below 7% in the majority of studies included in this review, but anti-HCV rates from 30 to 67% were found in ISU in Argentina and Brazil [39–41].

In NIDU, anti-HCV ranged from 0 to 10% with the highest values found in Brazil (8%), and Uruguay (10% in 2003) [42]. Studies conducted in alcohol abusers found 5.6% of anti-HCV in Southeast Brazil [37] and 15% in Southern Brazil [43] what could reflect the diminish in anti-HCV prevalence in this group. The pooled value for HCV prevalence in NIDU was 3.6% (95% CI 2.6–4.5%) [38].

HCV infection rate for IDU varied considerably between and within countries. The highest values were reported in Argentina (55% in 2001) [44], Brazil (53% in 1998, 46% in 2001) [45], Puerto Rico (89% in 2006) [46] and Mexico (Ciudad Juarez and Tijuana) (96% in 2005) [47]. Studies in Colombia (Bogota) found anti-HCV prevalence of 0 and 1.7% in IDU [48, 49]. Pooled regional anti-HCV prevalence among IDU was 49% (95% CI 22.6–76.3%) with significant heterogeneity among studies [38].

HCV current infection (both anti-HCV and HCV-RNA) varies from 0% in drug users from Venezuela [50] to almost 60% in IDU in North Brazil [41]. Only three studies from Brazil [41, 51–53] determined HCV genotypes. The study from Pará found a high prevalence of genotype 1b (42%), especially in NIDU (50%), while in the other two studies, individuals had genotype 1a in over 60%.

3.3. Hepatitis B and C prevalence in patients with chronic kidney disease patients under dialysis treatment

It is well known that patients undergoing dialysis treatment are at increased risk for contracting viral infections. The reasons may be their underlying impaired cellular immunity

and the blood exposure to infectious materials through the extracorporeal circulation for a prolonged period. Moreover, hemodialysis patients may require blood transfusion, frequent hospitalizations and surgery, which increase opportunities for nosocomial infection exposure [11]. Most frequent viral infections reported hemodialysis units are HBV, HCV and HIV [54]. These infections influence negatively the survival of the hemodialysis patients and those undergoing renal transplant [55].

Worldwide, HCV prevalence among patients on hemodialysis varies from as low as 1 to up to 70% [56] and the dialysis-related risk of HCV infection development is estimated at 2% per year [54]. Anti-HCV prevalence is low in Latin America (about 1.23%) [57] and varies from country to country, between regions of the same country and even among hemodialysis patients [58]. High anti-HCV prevalence was found in hemodialysis patients in Peru (59%) and from them, 4.5% had mixed infection with hepatitis B (HBsAg positive) [59]. In Venezuela, a study conducted in four hemodialysis units found 71% of anti-HCV and 25% of HBsAg among hemodialysis patients [60].

In Argentina, a study demonstrated a drop in anti-HCV prevalence in a same hemodialysis unit showing prevalence of 41.5% in 1994; 26.9% in 1996; 12% in 1998 and 8.5% in 2000 [61]. According to the Chronic Dialysis Registry of Argentina, anti-HCV prevalence decreased from 2% in 2004 to 1% in 2011 and global HCV prevalence was 4.9% in 2011 [62, 63].

In Chile, anti-HCV prevalence varied from 30% in hemodialysis patients at 1993 to 13% 2 years later [64, 65]. In Cuba, despite the implementation of anti-HCV screening in 1995, high anti-HCV positivity was found in hemodialysis patients in 2009 (76%) and 2010 (18.8%) [66, 67]. In Mexico, anti-HCV prevalence of 10.2% was observed in CKD patients and 12.7% in those at hemodialysis [68]. Years later, a study showed that among 149 patients in hemodialysis, 6.7% presented anti-HCV antibodies and from them, 5% presented HCV RNA [69]. Anti-HCV prevalence of 6.3, 6.5, 59% in hemodialysis patients from Uruguay, Colombia, Peru [59, 70, 71].

In Brazil, some studies have been performed to evaluate HCV prevalence in different hemodialysis units. In 2006, among 70 patients of the south region undergoing hemodialysis, seven (10%) presented HCV infection [72]. Still in 2006, but in Salvador city (Northeast Brazil), the anti-HCV prevalence among hemodialysis patients was 10.5% with detectable HCV RNA in 73.6% of them. In this study, the most frequent HCV genotype was genotype 1 followed by genotypes 3 and 2 [73]. In North region, anti-HCV prevalences from 4 to 14% were found in 7 dialysis center in Para State in 2013. In this study, HCV RNA was detected in 5.3% of the patients and genotype 1 was the most frequent, followed by genotypes 2 and 3 [74]. Recently, Barbosa-Ribeiro et al. [17] found 12.6% of anti-HCV prevalence in Hemodialysis patients at Northeast Brazil. In Southeast region, anti-HCV prevalence of 13 and 14.8% was found in 2008 and 2010 years [75, 76].

HBV prevalence varies in CKD patients in Latin America. In Mexico [77] found 7.1% of HBsAg prevalence in 10 hemodialysis units at 2010 and two of them were co-infected with HCV (0.5%) [77]. In Uruguay, HBsAg prevalence of 1% was found in hemodialysis patients probably due to mandatory screening of blood donors and patients for HBsAg since 1981 [71].

In Brazil, prevalence of HBsAg of 0, 2.4, 7, 10, 34.1% were reported in hemodialysis center in Southeast, Central, Northeast, South and Midwest regions of Brazil [78–82]. HBsAg prevalence of 4.5, 25, 1.4% was found in hemodialysis patients in Peru, Venezuela, Cuba [59, 67].

Among patients undergoing hemodialysis, it is relatively common to observe occult hepatitis B cases due to vial of transmission and prolonged vascular access [83]. In Brazil, prevalence of OBI of 1.5, 3 and 15% was found in Northeast and Southeast region of Brazil [83–85]. HBV genotype A was the most prevalent in these studies.

3.4. HBV and HCV infection among coagulopathy patients

Hereditary coagulopathies are hemorrhagic diseases resulting from deficiency of one or more plasma coagulation proteins, implying a reduction in the formation of thrombin which is a key factor for blood clotting. Among hereditary hemorrhagic disorders, hemophilia (type A and B) and von Willebrand's disease (VWD) are the most common [86]. Hemophilia A and B are X-linked hemorrhagic disorders caused by mutations in the factor VIII and factor IX genes, affecting almost exclusively male individuals. Both factors play a role in the intrinsic pathway of blood clotting and the affected individuals present severe, moderate and mild forms of disease defined by plasma coagulation factor levels [87]. While VWD is caused by a decreased or dysfunction of the protein called Von Willebrand Factor (VWF) and affects both genders. The diversity of mutations leads to the appearance of several clinical manifestations, manifesting with platelet dysfunction associated with the decrease of serum levels of factor VIII [88].

Worldwide, it is estimated that hemophilia affects 1 in 5000 newborns while VWD reaches from 0.8 to 2% of the population. According to the 2015 global annual report of the World Federation of Hemophilia, which included data from more than 304,000 people with hereditary coagulopathy from 111 countries, 49.7% of the cases were from hemophilia A, 9.9% from hemophilia B, 24.6% of DVW and 13.9% of other coagulopathies [86].

The treatment of coagulopathies is based on the replacement of the deficient coagulation factor, when there are hemorrhagic manifestations or as primary prophylaxis. This therapy increases the survival of these patients and their success in preventing the different hemorrhagic manifestations [89, 90]. On the other hand, due to multiple blood transfusions and use of cryoprecipitate, elaborated from a pool of frozen human plasma, these individuals are at risk for transmission of infectious agents, such as hepatitis B and C viruses [91, 92].

Most of viral infections occurred before 1985, when inactivation techniques were introduced in clotting factor concentrates. Thus, countries in Latin America, as well as other regions of the world, suffer the impact of these viral infections, which have evolved into chronic cases of the disease.

HBsAg prevalences were 2.4, 6, 24, 33.3 and 42% in coagulopathy patients from Mexico, Honduras, Cuba, Colombia, Peru [93–97]. In Brazil, it was possible to observe a significant decrease in the prevalence of HBsAg over the years, being 2.3% in 2007 and 1.0% in 2012 [98].

Regarding anti-HCV prevalence in coagulopathy patients, a universal screening in 1995 identified 51.6% of anti-HCV in hemophiliac patients from Cuba [95]. In 2007 to 2010, anti-HCV prevalence was 39.03% in this group in Cuba [99]. While in Colombia, patients from the

cities of Bogotá and Medellin in 2003 presented 32.2% of anti-HCV [74]. In Peru, a study with multi-transfused patients from the seven largest hospitals in the country revealed 56.6% of anti-HCV prevalence [97]. In Honduras, 8 hospitals in the cities of Tegucigalpa and San Pedro Sula identified anti-HCV prevalence of 26.9% [94]. In Mexico, 46.3% of anti-HCV prevalence was found in hemophiliacs at 2008 [93]. In Argentina, 42.7% of anti-HCV positivity was found in hemophiliacs from 2002 to 2004 [100]. As the same was found for HBV, Ferreira et al. [98] observed a decrease in anti-HCV prevalence from 24.2% in 2007 to 4.7% in 2012. However, recent study in coagulopathy patients from Northeast Brazil found 47% of anti-HCV prevalence [17].

4. Conclusion(s)

In Latin America countries, HBV and HCV infection are still great public health problem in individuals infected by HIV, CKD patients, coagulopathy patients, illicit substance abusers. Prevalences of these infections are higher in these individuals compared to general population and different patterns of epidemiology were found between and within countries probably due to differences in access to diagnosis and treatment in these regions. A fall in the prevalence of HBV and HCV infection has been observed in these groups due to HBV immunization and HCV screening especially among CKD and coagulopathy patients. However, outbreaks still happen in these groups showing the importance of education programs to prevent the transmission of these viruses.

The recommendations for each group are: among CKD and coagulopathy individuals, it is important to provide access to sensitive methods of diagnosis, screening of blood products and equipment and HBV vaccination. Among ISUs and HIV infected individuals, it is important to provide access to diagnosis, increase prevention and education campaigns to reduce the risk of acquiring HBV and HCV due to risky sexual behavior or sharing of needles and syringes. Vaccination against HBV should also be a priority in these groups. All these recommendations must be made in all countries of Latin America since epidemiological differences between HBV and HCV infection among countries is based on the different investments made in health, especially those related to diagnosis and prevention.

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Conflict of interest

The authors declare no conflict of interest.

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