



An Example of the Importance of Electronic Health Records from Mogadishu, Somalia: Hepatitis B Prevalence and Co-infections with Hepatitis C

Elektronik Sağlık Kayıtlarının Önemine Mogadişu, Somali'den Bir Örnek: Hepatit B Prevalansı ve Hepatit C ile Ko-enfeksiyonlar

Mustafa Mahir ÜLGÜ¹ [ID], Abdirahim ALI ADAM² [ID], Hasan KARAKUŞ³ [ID], Hilmi Erdem SÜMBÜL⁴ [ID]

¹General Directorate of Health Information Systems, Republic of Türkiye Ministry of Health, Ankara, Türkiye.

²Department of Infectious Disease and Clinical Microbiology, Mogadishu Somalia-Turkey Recep Tayyip Erdoğan Training and Research Hospital, University of Health Sciences, Mogadishu, Somalia.

³Department of Medical Microbiology, Gulhane Training and Research Hospital, Ankara, Türkiye.

⁴Department of Internal Medicine, Mogadishu Somalia-Turkey Recep Tayyip Erdoğan Training and Research Hospital, University of Health Sciences, Mogadishu, Somalia.

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Correspondence: Mustafa Mahir Ülgü; MD., PhD., General Directorate of Health Information Systems, Republic of Türkiye Ministry of Health, Ankara, Türkiye. E-mail: mahir.ulgu@saglik.gov.tr

Abstract

The epidemiology of hepatitis B virus (HBV) and hepatitis C virus (HCV) has been discussed in detail from different aspects around the world. Current epidemiological data has critical importance in the planning and carrying out of public health policies for the prevention of transmission and spread of these infections, and the treatment of chronic infections, and to reduce the burden and mortality associated with complications such as cirrhosis and liver cancer by national health authorities and international health institutions, especially the World Health Organization. Elimination of a social health problem is possible by first raising awareness, then determining the dimensions of the problem, and planning and implementing interventions for a solution. Somalia was in the position of a region where access to diagnosis and treatment for many life-threatening diseases was difficult, aside from the monitoring of public health criteria due to the unstable situations that has continued for more than 40 years. Until recently, basic health parameters and epidemiological predictions in Somalia were monitored through estimates based on data from neighboring countries or on data obtained from small groups from Somalia immigrants settled different parts of the world. However, this situation is changing rapidly. A tertiary education and research hospital established in the capital, Mogadishu, with the coordination of the Türkiye and Somalia governments, and which has become the largest health center in the country today; contributes to understanding the extent of the serious health problems faced by the country by pioneering specialized training and scientific studies, in addition to providing health care. Electronic health records have been kept regularly since 2015 in this hospital, where hundreds of thousands of patients receive treatment or undergo health checks every year and it has been the source of numerous retrospective epidemiological studies some of which have exceeded 100 thousand cases, in different age groups and sub-populations. These studies include human immunodeficiency virus (HIV) prevalence and complications, HCV prevalence and genotype distribution, prevalence and epidemiology of parasitic infections, incidence of tuberculosis and related complications, cancer incidence and distribution, causes of blindness, thyroid diseases, antibiotic resistance profiles, and the epidemiology of various organ-specific diseases. Dozens of

studies using the hospital records were included in the scientific literature between 2020 and 2023. In this study, a four-year period between November 2015 and November 2019, HBV serological test results of more than 100,000 different patients are presented. HBsAg and anti-HBs seropositivity for all age groups was found to be 8.1% (9,405/115,946) and 32.7% (25,988/79,410), respectively. HBsAg and anti-HBs seropositivity were significantly higher in males than females ($p < 0.001$). When the anti-HCV test results of HBsAg positive patients were examined, the rate of HCV co-infections was found to be 0.9% (82/9,405). HBV, HCV, and co-infection incidence tended to decrease over the years. Conversely, vaccination rates (especially in children under one year of age) tended to increase. While the comprehensive data presented in this study provide us with important and new information about the prevalence and co-infection rates of viral hepatitis in the country, many topics including HBV genotypes, hepatitis D frequency, access to treatment rates, complication rates, and HBV vaccination rates are still waiting to be researched in Somalia. In the region where it is not possible to carry out field studies, epidemiological data provided by electronic health records have become a country's window to the world.

Keywords: Somalia, Mogadishu, Hepatitis B, Hepatitis C, Co-infections, HBsAg, Anti-HBS, anti-HCV.

Özet

Hepatit B virusu (HBV) ve hepatit C virusu (HCV) epidemiyolojisi dünya genelinde farklı yönleri ile detaylı olarak ele alınmıştır. Güncel epidemiyolojik veriler başta Dünya Sağlık Örgütü olmak üzere uluslararası sağlık kuruluşları ve ulusal sağlık otoritelerince bu enfeksiyonların bulaşı ve yayılmasının önlenmesi, kronik enfeksiyonların tedavisi, siroz ve karaciğer kanseri gibi komplikasyonlar ile ilişkili yükün ve mortalite oranlarının azaltılmasına yönelik koruyucu halk sağlığı politikalarının planlanması ve yürütülmesi sürecinde kritik öneme sahiptir. Toplumsal bir sağlık sorununun ortadan kaldırılabilmesi, öncelikle bu konuda farkındalık oluşması, sonrasında ise sorunun boyutlarının belirlenmesi ile çözüme yönelik müdahalelerin planlanması ve uygulanması ile mümkündür. Somali 40 yılı aşkın bir süredir devam eden istikrarsız ortam nedeni ile toplumsal sağlık ölçütlerinin izlenmesi bir yana, yaşamı tehdit eden birçok hastalık için tanı ve tedaviye erişimin güç olduğu bir bölge konumunda idi. Somali'deki temel sağlık parametreleri ve epidemiyolojik öngörüler yakın zamana kadar komşu ülkelere ait veriler üzerinden veya Somali'den dünyanın farklı bölgelerine göç eden küçük gruplardan elde edilen verilere dayalı olarak yapılan tahminler ile izlenmekte idi. Bununla beraber, bu durum hızla değişiyor. Türkiye ve Somali hükümetlerinin koordinasyonu ile başkent Mogadişu'da kurulan ve günümüzde ülkenin en büyük sağlık merkezi haline gelen bir üçüncü basamak eğitim ve araştırma hastanesi; sağlık hizmetleri sunumu yanında, uzmanlık eğitimi ve bilimsel çalışmalara öncülük ederek ülkenin yüz yüze kaldığı ciddi sağlık sorunlarının boyutlarının anlaşılmasına katkı sağlamaktadır. Her yıl yüzbinlerce hastanın tedavi gördüğü veya sağlık kontrolünden geçtiği bu hastanede 2015 yılından beri düzenli olarak tutulan elektronik sağlık kayıtları; insan immünyetmezlik virusu (HIV) prevalansı ve komplikasyonları, HCV prevalansı ve genotip dağılımı, paraziter enfeksiyonların prevalansı ve epidemiyolojisi, tüberküloz ve ilişkili komplikasyonların görülme sıklığı, kanser insidansı ve dağılımı, körlük nedenleri, tiroid hastalıkları, antibiyotik direnç profilleri ve diğer çeşitli organ spesifik hastalıkların farklı yaş grupları ve alt-popülasyonlardaki epidemiyolojisi üzerine, bazıları için olgu sayılarının 100 bini aştığı çok sayıda retrospektif epidemiyolojik çalışmaya kaynak olmuştur. Hastane kayıtlarının kullanıldığı onlarca araştırma 2020-2023 yılları arasında bilimsel literatürde yerini almıştır. Bu çalışmada ise Kasım 2015-Kasım 2019 yılları arasını kapsayan dört yıllık bir dönemde 100.000'den fazla farklı hastaya ait HBV serolojik test sonuçları sunulmaktadır. Çalışmamızda tüm yaş grupları için HBsAg ve anti-HBs seropozitifliği sırasıyla %8.1 (9,405/115,946) ve %32.7 (25,988/79,410) olarak bulundu. HBsAg ve anti-HBs seropozitifliği erkeklerde kadınlara göre anlamlı derece daha yüksekti ($p < 0.001$). HBsAg pozitif hastalara ait anti-HCV test sonuçları incelendiğinde HCV ko-enfeksiyon oranı %0.9 (82/9,405) olarak bulundu. HBV, HCV ve ko-enfeksiyon sıklığı yıllar içerisinde azalma eğiliminde idi. Aşılama oranı ise (özellikle bir yaş altı çocuklarda) artma eğiliminde idi. Bu çalışmada sunulan kapsamlı veriler bize viral hepatitlerin ülkedeki yaygınlığı ve ko-enfeksiyon oranları hakkında önemli ve yeni bilgiler sunarken, Somali özelinde HBV genotipleri, hepatit D sıklığı, tedaviye erişim oranları, komplikasyon oranları ve HBV aşılama oranları gibi birçok konu başlığı halen araştırılmayı beklemektedir. Saha çalışmalarını yürütmenin mümkün olmadığı bu bölgede elektronik sağlık kayıtlarının sunduğu epidemiyolojik veriler ülkenin dünyaya açılan bir penceresi olmuştur.

Anahtar Kelimeler: Somali, Mogadişu, Hepatit B, Hepatit C, Ko-enfeksiyonlar, HBsAg, Anti-HBS, anti-HCV.

Introduction

Hepatitis B virus (HBV) and hepatitis C virus (HCV) infections are major public health problems worldwide [1]. The estimated global burden of these infections by World Health Organization is that more than 296 million and 58 million people were living with chronic HBV and HCV, respectively, in 2019 [2,3]. The African continent covers some of the regions most affected by HBV and HCV infections worldwide [4,5]. Information on the prevalence of HBV and HCV infections and associated complications in Somalia is limited. Due to similar modes of transmission, HBV-HCV co-infection is a common phenomenon, especially in areas where the two viruses are endemic and in individuals at high risk of parenteral infection [1]. Although information regarding the clinical significance of HBV-HCV co-infections remains incomplete, disease severity and adverse outcomes as well as choice of treatment options are additional problems brought about by the presence of co-infection [1]. Compared with a single infection, HBV/HCV co-infected patients tend to have more severe liver damage, a higher risk of hepatic decompensation and cirrhosis, and higher hepatocellular carcinoma case [1,6].

In this study, it was aimed to reveal the HBV seroepidemiology and HBV-HCV co-infection rate in individuals from all age groups who applied to our hospital over a period of four years and to raise awareness about taking preventive measures against HBV and HCV infections.

Material and Method

The study was conducted after obtaining approval from the institutional ethics committee (Ethics Committee of Somalia Turkey Recep Tayyip Erdogan Education and Research Hospital, date: 05.12.2019, decision no: 183, number: MSTH/2724), and the study carried out in accordance with the tenets of the Declaration of Helsinki.

Study population and design

This study was conducted between November 2015 and November 2019 in Mogadishu Somalia-Turkey Recep Tayyip Erdoğan Training and Research Hospital. The positivity rates of anti-HBs and HBs-Ag serological markers reported in all

patients who applied to our hospital for different reasons during the four-year period were investigated. HBsAg and anti-HCV test results were also compared to determine the HBV/HCV co-infection rate. All data were obtained from hospital electronic information management system. Repeated results of the same patient were excluded from the study. If seroconversion occurred during the study period, the patient's negative results were excluded from the study and the patient's positive result was included in the study. When evaluating patient age, for patients with the same result from multiple tests, the patient's age was determined according to the date of the first test.

Anti-HBc IgM and anti-HBe tests, which were studied for a very small number of patients (only 59 patients and only 128 patients, respectively), were excluded from the study and comparative analyses. There was no testing for hepatitis D virus during the study period and therefore the prevalence of hepatitis D virus (HDV) delta antigen seropositivity rate and HBV-HDV co-infections could not be investigated.

Serological tests

Anti-HBs and HBsAg tests were performed using the Architect Kits (Abbott Diagnostics, Germany) on the Architect I 2000 SR system (Abbott Diagnostics, USA). All tests' results were evaluated in accordance with the manufacturer's instructions. The test was run again (*retested*) when there were borderline values.

Anti-HCV tests were performed using the Architect Kits (Abbott Diagnostics, Germany) on the Architect I 2000 SR system according to manufacturer's instructions (explained in detail in the reference [7])

Statistical analysis

The data were compiled and analyzed using SPSS v. 22.0 (IBM SPSS Statistics Version 22.0, Armonk, NY: IBM Corp.). Frequency, mean, and standard deviation values were calculated for sub-groups. Chi-square tests and Fisher's exact probability tests were used to comparison between groups. Results were considered statistically significant when $p < 0.05$ with a 95% confidence interval (CI).

Results

During the study period, a total of 84,432 anti-HBs tests were performed for 79,410 different patients and a total of 124,452 HBsAg tests were performed for 115,946 different patients.

Repeated results were excluded and anti-HBs positivity was found as 32.7% (25,988/79,410). The distribution of anti-HBs positivity rates by age groups and years is presented in Table 1. Of the 79,410 patients 43,391 (54.6%) were male and 36,019 (45.4%) were female. The anti-HBs positivity rates in men and women were 33.9% (n=14,726) and 31.3% (n=11,262), respectively. Anti-HBs seropositivity was significantly higher in males than females (p<0.001). The general average age of 79,410 patients who underwent anti-HBs testing was 34.86±19.84, and the average age of anti-HBs positive patients was found to be 43.7±21.87. Anti-HBs seropositivity rate was found to be high in children under 1 year of age due to the effect of the vaccination

campaign, and it tended to increase with age in other groups (Figure 1). High anti-HBs positivity rate in children under 1 year age, which increased by years and exceeded 40% in 2019, indicated the increasing interest of the society in the vaccination campaign. When all age groups were evaluated, no change was observed anti-HBs positivity rate over the years.

When repeated results were excluded, the HBsAg positivity rate in the study group was found to be 8.1% (9,405/115,946). The distribution of HBsAg positivity rates by age groups and years is presented in Table 2. Of the 115,946 patients, 60,826 (52.5%) are male and 55,120 (47.5%) are female patients. HBsAg positivity rates in men and women were found to be 9.2% (n=5,592) and 6.9% (n=3,813), respectively. HBsAg positivity was significantly higher in men than in women (p<0.001). While the general average age of 115,946 patients was 37.09±20.07, the average age of HBsAg positive patients was found to be higher (44.37±17.86).

Table 1. Anti-HBs seropositivity according to age groups in study population (2015-2019).

Year	< 1 age		1-15 age		16-45 age		46-65 age		>65 age		Total (n= 79,410)	
	Positive n (%)	Negative n	Positive n (%)	Negative n	Positive n (%)	Negative n	Positive n (%)	Negative n	Positive n (%)	Negative n	Positive n (%)	Negative n
2015	0 (0)	12	12 (13.6)	76	119 (28.3)	301	92 (56.4)	71	51 (53.7)	44	274 (35.2)	504
2016	11 (31.4)	24	44 (13.7)	277	660 (24)	2,085	514 (46.6)	589	345 (55.5)	277	1,574 (32.6)	3,252
2017	54 (30.2)	125	259 (21.1)	971	1,957 (26.5)	5,437	1,298 (51.2)	1,237	1,044 (65.6)	548	4,612 (35.7)	8,318
2018	112 (34.8)	210	593 (24.5)	1,826	3,868 (26.6)	10,684	2,413 (52.3)	2,200	1,727 (66.4)	873	8,713 (35.6)	15,793
2019	143 (40.7)	208	879 (24.5)	2,710	5,587 (22.4)	19,344	2,627 (51.5)	2,470	1,579 (65.7)	823	10,815 (29.7)	25,555
Total	320 (35.6)	579	1,787 (23.4)	5,860	12,191 (24.4)	37,851	6,944 (51.4)	6,567	4,746 (64.9)	2,565	25,988 (32.7)	53,422

Table 2. HBsAg seropositivity according to age groups in study population (2015-2019).

Year	< 1 age		1-15 age		16-45 age		46-65 age		>65 age		Total (n= 115,946)	
	Positive n (%)	Negative n	Positive n (%)	Negative n	Positive n (%)	Negative n	Positive n (%)	Negative n	Positive n (%)	Negative n	Positive n (%)	Negative n
2015	1 (3.2)	30	12 (7.7)	144	190 (15.9)	1,006	93 (21)	350	42 (16.1)	219	338 (16.2)	1,749
2016	3 (4)	72	15 (2.5)	584	526 (7.3)	6,724	357 (11.9)	2,643	170 (9.8)	1,568	1,071 (8.5)	11,591
2017	1 (0.4)	226	18 (1.2)	1,513	917 (7.1)	12,006	548 (12)	4,003	283 (10.2)	2,479	1,767 (8.0)	20,227
2018	2 (0.6)	337	48 (1.8)	2,618	1,635 (8.2)	18,403	969 (13.3)	6,330	383 (9.4)	3,681	3,037 (8.8)	31,369
2019	2 (0.5)	385	59 (1.5)	3,803	1,813 (6.1)	27,865	934 (12.9)	6,328	384 (10.6)	3,224	3,192 (7.1)	41,605
Total	9 (0.8)	1,050	152 (1.7)	8,662	5,081 (7.1)	66,004	2,901 (12.9)	19,654	1,262 (10.2)	11,171	9,405 (8.1)	106,541

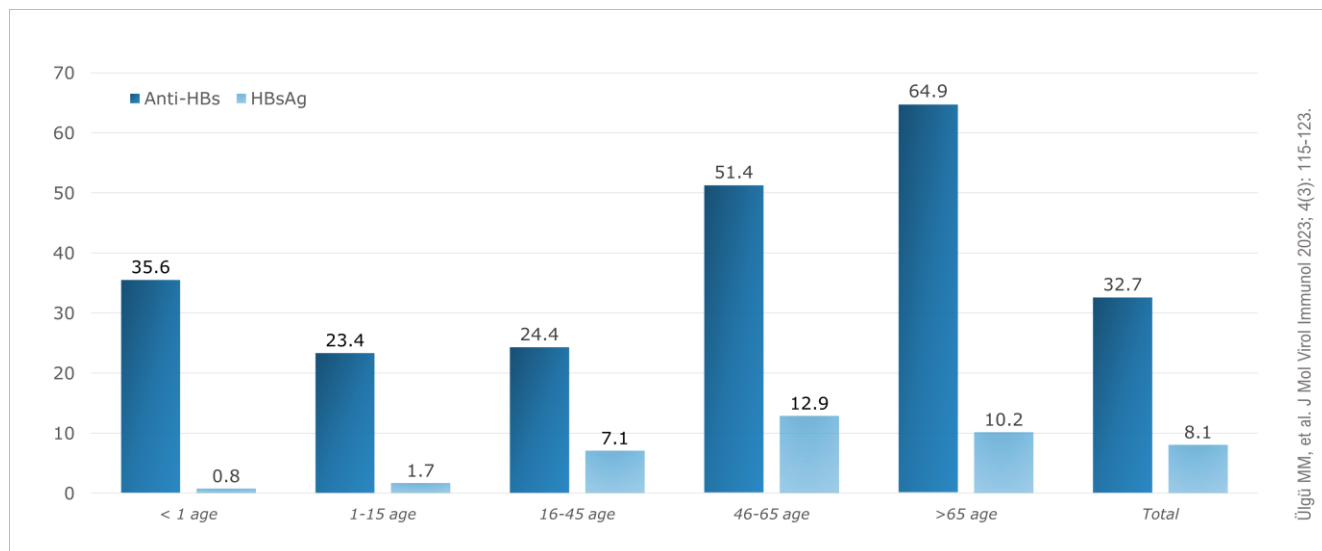


Figure 1. Seropositivity rates for Anti-HBs and HBsAg by age groups.

Anti-HCV test results from an our previously published study [7] were regrouped according to age and years in order to be comparable with HBsAg test results (Table 3). Co-infection rates are presented in a separate table (Table 4). There were 1.41% (n=1,447) anti-HCV positive patients among 102,601 different patients, 82 of these patients (5.7%) were also HBsAg positive. The co-infection rate among HBsAg positive patients, which is a more common condition in the society than anti-HCV seropositivity, was 0.9% (82/9405). Of the co-infected patients, 48 (58.5%) were male and 34 (41.5) were female. However, when looking at the total of 9,405 HBsAg positive patients, the co-infection rate for both male and female patients was 0.9% (p = 0.862). Only one of the patients with co-infection (a 39-year-old male patient) was identified as HCV genotype 1-b, HCV or HBV genotype

determination was not performed for the other patients. HBV-HCV co-infection was never observed in patients under 15 years of age, but 84.1% (69/82) of patients with co-infection were over 45 years of age and the average age of co-infected patients was over 60 years of age (60.97±14.07). Anti-HCV seropositivity had the highest rate (5.9%) above 65 years of age (Table 3). HBsAg and anti-HCV seroconversion was detected in 273 and 6 patients, respectively; however, these cases were not associated with co-infection. While anti-HCV and HBsAg seropositivity (Figure 2) and HBV and HCV co-infection rates (Table 4) tended to increase in older ages, in general HBsAg, anti-HCV, and co-infections rates tended to decrease over the years (2015 to 2019); HBsAg from 16.2% to 7.1% (Table 2), anti-HCV from 2.8% to 1.0% (Table 3), and co-infections from 1.2% to 0.6% (Table 4).

Table 3. Anti-HCV seropositivity according to age groups in study population (2015-2019).*

Year	< 1 age		1-15 age		16-45 age		46-65 age		>65 age		Total (n=102,601)	
	Positive n (%)	Negative n	Positive n (%)	Negative n	Positive n (%)	Negative n	Positive n (%)	Negative n	Positive n (%)	Negative n	Positive n (%)	Negative n
2015	6 (2.4)	19	4 (2.8)	138	10 (1.1)	874	12 (4)	286	10 (5.7)	164	42 (2.8)	1,481
2016	5 (6.8)	69	3 (0.5)	577	49 (0.7)	6,783	102 (3.7)	2,680	127 (8)	1,454	286 (2.4)	11,563
2017	2 (0.9)	220	1 (0.1)	1,460	49 (0.4)	11,975	138 (3.3)	4,066	182 (7.1)	2,370	372 (1.8)	20,091
2018	0 (0)	320	2 (0.1)	2,270	61 (0.4)	17,063	123 (2.0)	6,018	165 (4.8)	3,244	351 (1.2)	28,915
2019	1 (0.3)	366	1 (0)	3,507	104 (0.4)	26,269	132 (2.1)	6,025	158 (5.1)	2,937	396 (1)	39,104
Total	14 (1.4)	994	11 (0.1)	7,952	273 (0.4)	62,964	507 (2.6)	19,075	642 (5.9)	10,169	1,447 (1.4)	101,154

*Although the anti-HCV data presented in this table was published in our previous study [7], a new table was created according to age groups and years for comparison with HBsAg results.

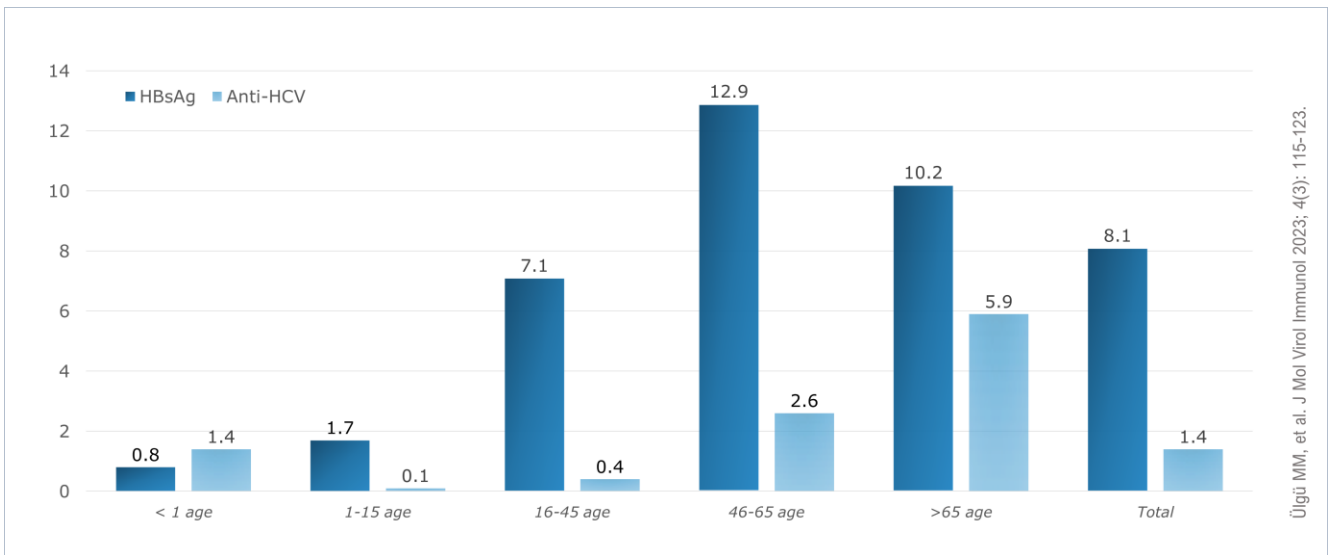


Figure 2. Seropositivity rates for HBsAg and Anti-HCV by age groups.

Table 4. Hepatitis B and hepatitis C co-infected (*HBsAg* and *anti-HCV* positive) patients (2015-2019).

Year	< 1 age		1-15 age		16-45 age		46-65 age		>65 age		Total (n=9,405)	
	anti-HCV positive n (%)	anti-HCV negative	anti-HCV positive n (%)	anti-HCV negative	anti-HCV positive n (%)	anti-HCV negative	anti-HCV positive n (%)	anti-HCV negative	anti-HCV positive n (%)	anti-HCV negative	anti-HCV positive n (%)	anti-HCV negative
2015	0 (0)	1	0 (0)	12	1 (0.5)	189	0 (0)	93	3 (7.1)	39	4 (1.2)	334
2016	0 (0)	3	0 (0)	15	5 (1)	521	7 (2)	350	5 (2.9)	165	17 (1.6)	1054
2017	0 (0)	1	0 (0)	18	1 (0.1)	916	13 (2.4)	535	10 (3.5)	273	24 (1.4)	1743
2018	0 (0)	2	0 (0)	48	1 (0.1)	1,634	11 (1.1)	958	6 (1.6)	377	18 (0.6)	3019
2019	0 (0)	2	0 (0)	59	5 (0.3)	1,808	8 (0.9)	926	6 (1.6)	378	19 (0.6)	3173
Total	0 (0)	9	0 (0)	152	13 (0.3)	5,068	39 (1.3)	2862	30 (2.4)	1232	82 (0.9)	9323

Discussion

Decades of instability in Somalia has caused problems in education, safety, socio-economic conditions, access to basic health needs and many other areas that will take time to repair. The prevalence and burden of many diseases in Somalia were until recently based on data from neighboring countries or on studies conducted on camps where refugees who had to leave the country settled, and mostly on immigrants who settled in western countries. However, there have been promising developments in the last few years. A tertiary care hospital, established with the coordination of the Ministry of Health of the Republic of Türkiye and the Ministry of Health of Somalia and providing health services to hundreds of thousands of people in Mogadishu since 2015, has become the largest and most

comprehensive health center in the country. The hospital continues to collaborate with Türkiye in many areas, including access to advanced health services and education.

When we look at the last 30-40 years, it can be seen that the literature on health data in Somalia is almost non-existent. However, after a 40-year gap, the epidemiological data obtained through the electronic information system of the hospital mentioned in the last few years have begun to make significant contributions to the literature. Retrospective data obtained from hospital electronic health records have been analyzed in comprehensive studies and have recently appeared in the literature (2020-2023), furthermore some of these studies include data from more than 100 thousand different patients. As an example, some studies cover the following

topics; HIV infection and its complications [8,9], HCV prevalence and genotype distribution [7,10], prevalence of intestinal parasitic infections [11], change in the frequency of malaria over the years [12], tuberculosis prevalence and complications [13–15], incidence and distribution of cancer cases [16], antibiotic resistance rates [17,18], frequency of thyroid diseases [19], causes of blindness [20], and prevalence of various other organ-specific diseases and infections [21–23].

In the present study, which was added to the aforementioned studies and is the most comprehensive study on the epidemiology of HBV infections in Somalia, investigated the prevalence of HBV infections in more than 100 thousand patients from different age groups. The study also includes comparative analysis and co-infection data with HCV prevalence data obtained in a previous study [7], which was conducted on the same hospital database and included more than 100 thousand patients.

In a previous study conducted in our hospital and covering a two and a half year period (2017-2019), HBsAg seroprevalence was found to be 8.2% [10]. In the same study, anti-HBs seroprevalence was found to be 32.2% and anti-HCV seroprevalence was 1.9%. Unlike the mentioned study, in our study, the scope of the research was expanded retrospectively (from the first year of establishment of the hospital) and the distribution of HBsAg and anti-HBS seropositivity rates by years and different age groups and the frequency of HBV-HCV co-infections were examined. When repeating results for the same patient were excluded, in our study where the data of 115,946 different patients were examined, the HBsAg seroprevalence was found to be 8.1%, while the anti-HBs seropositivity rate for 79,410 different patients was found to be 32.7%. Although these results are generally similar to the previous study, in our study, HBsAg prevalence and anti-HBS seropositivity were discussed from different aspects in our study. Together with very low HBsAg seropositivity, anti-HBs rate exceeding 40% with an increasing trend until 2019 show the effectiveness of vaccine applications carried out in our hospital in under one year of age. High rates of HBV and HCV in male gender and older age represent the high risk of injury, which was a

common situation in the past, inappropriate blood transfusion, invasive medical interventions performed in places where there is a risk of contamination. Consistent with this data, in a study conducted at our hospital, liver cancer was found to be the second most common cancer in men in Somalia, while the incidence of liver cancer was twice as high in men as in women [16].

HBV-HCV co-infection is a complex clinical condition with a worldwide prevalence estimated at 1-15% [24]. clinical studies have shown that HBV-HCV co-infected patients have a faster disease progression and a higher development of hepatocellular carcinoma compared to mono-infected patients [24]. In a comprehensive study conducted in our hospital and including more than 100 thousand people, anti-HCV seroprevalence was found to be 1.41% [7]. Although the prevalence of HCV infections in Somalia is relatively low compared to nearby Yemen (2%) and Egypt (14.7%) [5], HCV infections continue to be a serious public health problem in Somalia due to the limitations in access to treatment and the lack of a preventive vaccine. In our study, the increasing trend of anti-HCV seropositivity and the frequency of co-infection with HBV over the years and the highest rates reached in the >65 age group are noteworthy. Despite these negative situations, a promising epidemiological data revealed by our study results is that the frequency of HBV, HCV and co-infection tends to decrease over the years (from 2015 to 2019).

Limitations of the study are that serological results could not be confirmed due to the lack of molecular diagnostic methods and that genotype distributions could not be analyzed. Laboratory results were automatically transferred to the hospital electronic information system, but other patient data such as clinical information and treatment practices were not recorded in detail, probably due to scarcity of trained personnel, workload, and lack of awareness. This topic remains as a subheading waiting to be developed.

Conclusion

The data, comparative evaluations and determination of co-infection rates presented in this study may guide the preventive health practices to be planned throughout the country

and the activities of national and international health organizations for the future. This study also serves as a special example of the importance of electronic health records in a region where it is not possible to conduct field studies for many reasons, and its contribution to presenting

epidemiological data to the world in a region that is considered a closed area due to unstable conditions. The increase in vaccination rates over the years and the decreasing trend in infection rates have been recorded as hopeful observations for the future.

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