

Seroepidemiology of hepatitis B in individuals born between 1945-1985 on a Brazilian regional metropolis

Soroepidemiologia da hepatite B em indivíduos nascidos entre 1945-1985 em uma metrópole regional Brasileira

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Abstract

Background: hepatitis B prevalence can be influenced by social/cultural behavior and the Baby Boomer (BB) generation (1945-1964) may have been more susceptible to this infection. **Objectives:** We investigated the seroprevalence of markers for HBV infection and vaccination and its association with main risk factors. **Methodology:** a random sample of individuals aged 30-70 years old in a public clinical laboratory from a metropolitan area of Bahia/Brazil were tested for HBsAg/Total Anti-HBc/Anti-HBs/Anti-HBc-IgM and a socio-demographic questionnaire was applied. **Results:** of the 650 participants, 349 were 51-70 yo (BB) and 301 were non-BB. The prevalences were HBsAg (2.3%), Total Anti-HBc (17.1%) and Anti-HBs (27.4%). Anti-HBcIgM (2.7%) was performed in 112 participants sera who had contact/infection with HBV. The laboratory profiles were characterized as susceptibility (68%), vaccine response (14.8%) and contact/infection with HBV (17.2%). BB participants were more susceptible and less vaccinated than non-BB. The higher frequency of contact/infection status was observed in the BB generation. Statistically significant differences were found for the contact/infection status in males (50.9%) illicit drug use (11.6%), syringe/needle sharing (7.1%), and blood transfusion (10.7%). Non-BB with contact/infection profile reported more tattoo/piercing and BB reported higher use of glass syringes. **Conclusion:** the majority of the study population was susceptible to infection but participants older than 50 years showed both, a higher frequency of this profile and also a higher frequency of contact/infection status, thus suggesting the need for greater health care attention for this age group.

Key words: Age Distribution. Elderly. Serologic Tests. Needle Sharing. Unsafe Sex

Resumo

Introdução: a prevalência de hepatite B pode ser influenciada pelo comportamento sociocultural e a geração Baby Boomer (BB) (1945-1964) pode ter sido mais suscetível a esta infecção. **Objetivos:** Investigar a soroprevalência de marcadores para a infecção pelo VHB e resposta vacinal e associação com fatores de risco. **Metodologia:** soro de indivíduos de 30 a 70 anos randomicamente selecionados em um laboratório público de análises clínicas na área metropolitana do Brasil foram testados para AgHBs/ Anti-HBc Total /Anti-HBs/Anti-HBc-IgM. Todos responderam questionário sociodemográfico contendo perguntas sobre fatores de risco para hepatite B. **Resultados:** dos 650 participantes, 349 eram BB (51-70 anos) e 301 eram não-BB (30-50 anos). As prevalências estimadas foram: HBsAg (2,3%), Anti-HBs (27,4%). Entre os Anti-HBc Total (17,1%) apenas 2,7% foram Anti-HBc IgM. Os perfis laboratoriais foram caracterizados como suscetibilidade (68%), resposta vacinal (14,8%) e contato com VHB (17,2%). Na distribuição por idade, os BB foram mais suscetíveis, menos vacinados e apresentaram maior frequência de contato/infecção que os não-BB. Diferenças estatisticamente significantes foram encontradas no status contato/infecção e as seguintes variáveis: sexo masculino, uso de drogas ilícitas, compartilhamento de seringas de vidro/agulhas e transfusão de sangue. Não-BB com status contato/infecção relataram ter mais tatuagem/piercing e BB relataram maior uso de seringas de vidro. **Conclusão:** a maioria da população estudada era suscetível ao VHB, mas os participantes com mais de 50 anos apresentaram tanto uma maior frequência desse status quanto do status contato/infecção, sugerindo a necessidade de maior atenção à saúde para indivíduos desta faixa etária.

Palavras-chaves: Distribuição por Idade. Idosos. Testes Sorológicos. Uso Comum de Agulhas e Seringas. Sexo sem Proteção.

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INTRODUCTION

Hepatitis B is a disease caused by HBV and currently it is still considered a serious global public health problem.

^(1,2) This disease may occur in a silent manner and the immune response to the virus by the host may lead to severe chronic liver damage that may progress to cirrhosis or hepatocarcinoma.⁽³⁾ There is a highly effective vaccine, genetically engineered in 1986 and is still being in use.⁽⁴⁾

HBV transmission occurs through cutaneous and mucosal exposures to blood and/or contaminated body fluids (unprotected sex, use of syringe-sharing, needles or other devices, blood transfusions and contaminated derivatives, mother-to-child and intra-household transmission).⁽⁵⁾ Therefore, the adoption of preventive measures such as safe sexual practices through the use of condoms, non-sharing of personal use items (toothbrushes, manicure tools and razor blades) and syringes, needles or other devices for the use of drugs, are prophylactic measures relevant to the interruption of the HBV transmission chain.^(6,7)

In the general population, there are routine habits and behaviors that may affect the prevalence of this infection and it is pertinent to know more deeply the socio-epidemiological characteristics of the Baby Boomer generation (BB), which was born after World War II (1945-1964), a period marked by a significant increase of birth rate. BB individuals challenged established behavior patterns and experienced greater freedom by having practices that may have increased the risk of infections in young people that became chronic illnesses in adulthood.⁽⁸⁻¹¹⁾ These individuals lived through a time of significant behavioral changes, developing habits such as unprotected sexual contacts, use of illicit drugs sharing syringes and needles which may have influenced the spread of infectious diseases.⁽¹²⁾

In addition, in Brazil, there are references regarding the intra-household use of glass syringes and boiled sterilized needles for the injection of vitamins until the 70s and 80s, before being replaced by disposable syringes and needles.⁽¹³⁾

As the life expectancy of the Brazilian population has increased in recent years the Baby Boomers, now over 51 years old, make up a representative segment of the population.^(14,15) As only in 2015 hepatitis B vaccination was made available in the public health system for individuals of this age group⁽¹⁶⁾, that is mostly composed of people with active sexual life and usually resistant to condom use. Thus, susceptibility to the disease in this population is a cause for concern.

According to WHO, hepatitis B must be considered a public health challenge because, despite the existence of a highly effective vaccine, it is still endemic in several regions of the world, and it was not considered, by several countries, as a priority disease to be targeted. For this reason, strategies were adopted so that, by 2030, this disease is supposed to be eliminated worldwide.^(17,18)

In view of this scenario, the objective of the present study was to determine the prevalence of markers of infection, contact and probable vaccination against hepatitis B and to evaluate the possible association with some risk factors referring to habits and conduct and medical proce-

dures in individuals born in the period from 1945 to 1985.

MATERIALS AND METHODS

Study Design, Population and Sampling Calculus

A descriptive cross-sectional study with a population composed of individuals born between 1945 and 1985 (30 to 70 years). After the draw, they were invited to participate in the research, during their attendance to perform laboratory tests, from April 2015 to October 2016, in a laboratory diagnostic sector accredited by the public health system (SUS) of Bahia.

The sample size calculation of 650 individuals was done considering the prevalence of 7.3% of Anti-HBc in the state of Bahia, for the age group over 50 years old.⁽²³⁾

Application of the Sociodemographic Questionnaire

The sociodemographic and epidemiological questionnaire contained questions about medical and therapeutic habits, behaviors and procedures related to hepatitis B transmission (Self-reported vaccination schedule without evidence of vaccination card, blood transfusion before 1993, tattooing/piercing, unprotected intercourse, previous surgeries, illicit drugs, illicit injectable drugs, syringe or needle sharing, use of glass syringe, dental treatment, use of injectable vitamin complexes, sharing personal objects (pliers, shavers, toothbrushes), hazardous occupations and occurrence of accidents at work.

Activities carried out in environments identified with possible biological exposures such as hospitals, clinical and forensic analysis laboratories, tattoo/piercing studios, beauty salons and street cleaning were considered as occupational risk.

Collection of Samples and Laboratory Analysis

Blood was collected and serum stored at -20°C until chemiluminescence (ARCHITECT i2000sr[®] from Abbott) for HBsAg, Total Anti-HBc and Anti-HBs was performed. All tests were validated with specific "positive" and "negative" controls. Samples with positive or undetermined results for HBsAg and / or total anti-HBc were repeated and tested for Anti-HBc IgM and those positive for HBsAg were also retested.

The contact/infection status comprised the serological profiles defined as: acute infection (HBsAg +/Total Anti HBc+/Anti-HBc IgM+) and chronic (HBsAg+/Total anti-HBc+), Positive Anti-HBc isolated marker (Total Anti-HBc+, as the sole serological marker), prior contact (HBsAg-/Total Anti-HBc+/Anti-HBs+), Positive HBsAg isolated marker (HBsAg+/Total Anti-HBc-), immunological window (Anti-HBc+/Anti-HBc IgM+), convalescent phase start (HBsAg-/Anti Hbs+/Total Anti HBc+/Anti-HBc IgM+). The two-other status considered in this study included

vaccine response (Anti-HBs+) and susceptibility (negative serological markers).^(6,20)

reference team at the Professor Edgard Santos University Hospital, Federal University of Bahia, Brazil.

Statistical analysis

The results of the research registered in a database were analyzed with the statistical package SPSS (version 17.0). Pearson's Chi-Square Test or the Fisher's Exact

Test were used for the association of the results. All associations with $p < 0.05$ were considered statistically significant.

Ethical Considerations

This project was approved by the Institutional Ethics Committee. Equally, the recommendations of Resolution 466/2012 of the Ministry of Health and National Health Council were followed. Individuals who agreed to participate in the study signed a free and informed consent form (TCLE). Participants with positive results for HBsAg, Total Anti-HBc or Anti-HBc IgM were referred to the Hepatology

RESULTS

A total of 650 individuals with a mean age of 50.62 ± 10.64 , mean age 52 years (IQ: 42-59 years) participated in the study; 349(53.7%) were 51 to 70 years old (Baby Boomer/BB) and 301(46.3%) were 30 to 50 years old (non-BB). The majority were female 442(68%). In relation to marital status, married and individuals in stable relationships accounted for 375(57.7%), while single, widowed and divorced individuals accounted for 275(42.3%). The majority of the population(61.2%) reported no schooling or incomplete elementary school. A total of 303(46.6%) participants reported receiving up to 1 minimum family income salary. Regarding occupation, 58(8.9%) participants reported activities with possible exposure to biological agents and/or fluids. Some socio-demographic aspects of the studied group are found in Table 1.

Table 1 – Socio-demographic data of the population aged 30 to 70 residing in a Brazilian regional metropolis associated with susceptibility, vaccine response and exposure to hepatitis B virus

SOCIODEMOGRAPHIC DATA	STATUS (n=650)		
	Susceptibility ¹ n=442 n(%)	Vaccine Response ² n=96 n(%)	Contact/Infection With HBV ³ n=112 n(%)
AGE (years old) mean (SD)	51±10,47	45±10,15	53±9,89
Baby Boomer 51-70 (1945-1964)	255 (57,7)	26 (27,1)	68 (60,7)
Non-Baby Boomer 30 - 50 (1965-1985)	187(42,3)	70 (72,9)	44 (39,3)
GENDER			
Male	126 (28,5)	25 (26,0)	57 (50,9)
Female	316 (71,5)	71 (74,0)	55 (49,1)
MARITAL STATUS			
"Withoutpartner"			
Single	102 (23,1)	31 (32,3)	41 (36,6)
Divorced	38 (8,6)	8 (8,3)	12 (10,7)
Widowed	32 (7,2)	4 (4,2)	7 (6,3)
"Withpartner"			
Marriage	167 (37,8)	34 (35,4)	30 (26,8)
Stablerelationship	103 (23,3)	19 (19,8)	22 (19,6)
RACE			
White	35 (7,9)	7 (7,3)	9 (8,0)
Afrodscendants	177 (40,1)	41 (42,7)	48 (42,9)
Mixedrace	228 (51,6)	47 (49,0)	54 (48,2)
Others	2 (0,4)	1 (1,0)	1 (0,9)
SCHOOLING			
Illiterate	14 (3,2)	1 (1,0)	5 (4,5)
Incomplete 1st grade	190 (43,0)	26 (27,1)	47 (41,9)
Complete 1st grade	79 (17,9)	17 (17,7)	19 (17,0)
Complete 2st grade	146 (33,0)	47 (49,0)	39 (34,8)
Complete 3st grade	13 (2,9)	5 (5,2)	2 (1,8)
FAMILY INCOME			
<1 minimum salary*	65 (14,7)	9 (9,4)	13 (11,6)
1 minimum salary*	143 (32,4)	31 (32,3)	42 (37,5)
1-3 minimum salaries*	207 (46,8)	50 (52,1)	48 (42,9)
>3 minimum salaries*	27 (6,1)	6 (6,2)	9 (8,0)
OCCUPATIONAL BIOLOGICAL EXPOSURE			
Yes	34(7,7)	13(13,5)	11(9,8)
No	408(92,3)	83(86,5)	101(90,2)

¹AgHBs+, anti-HBc Total-, anti-HBs-

²Anti-HBs+

³AgHBs+ e/ou Anti-HBc Total+/--. Considering serological profile of contact/infection by positive anti-HBc marker (anti-HBc+, excl) and positive HBsAg marker (AgHBs+)

*Value of the minimum salary in 2015 and 2016: R. \$ 788 and 880 reais, respectively. Average value of 1 dollar: R. \$ 3,30 in 2015 and R. \$ 3,50 in 2016.

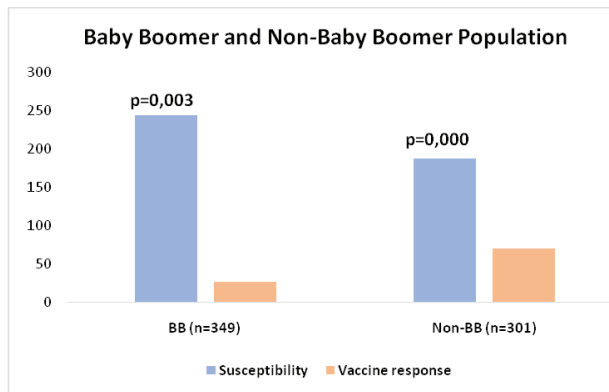
Source: Author

The prevalence of serological markers in the total population was: 2.3% for HBsAg, 17.1% for Total Anti-HBc and 27.4% for Anti-HBs. The anti-HBc IgM test presented a prevalence of 2.7% and was only performed in the participants who presented HBV infection serological markers (n=112).

Table 1 shows the frequencies of the three-status defined based on the profiles of serological markers: susceptibility 442/68% (HBsAg-/Anti-HBcTotal-/Anti-HBs-), vaccine response 96/14.8% (HBsAg-/Anti-HBcTotal-/

Anti-HBs+) and contact/infection with HBV 112/17,2% (HBsAg+/Anti-HBc+/Anti-HBc IgM+). The mean age of the participants with the susceptibility status was 51±10.47 years, being more frequent in the BB generation (57.7%). The percentage of individuals of the non-BB generation was higher in the group with a vaccine response(72.9%). It was observed that BB participants were more susceptible than non-BB subjects(p=0.003). The inverse was observed in the profile of vaccine response (p=0.000), in which BB participants were less vaccinated. (Graphic 1)

Graphic 1 – Frequency of susceptibility and hepatitis B vaccine response status in Baby Boomer and non-Baby Boomer populations. BB generation individuals were more susceptible to hepatitis B virus infection and less vaccinated against hepatitis B than non-BB.



Source: Author

In the third status, contact/infection, the mean age of participants was 53±9.89 years.

For the different serological profiles related to contact/infection status (112) and presented in Table 2, the following prevalences were found: 71.4% of previous contact, 13.4% of positive Anti-HBc isolated marker, 11,6% of

chronic infection. For the immunological window profiles, acute infection, positive HBsAg isolated marker and early convalescent phase was found in each, the prevalence of 0.9%.

Table 2 – Serological panel and frequency of different laboratory profiles of contact/infection with HBV

Serological Panel	Laboratory Profiles	n (%)
AgHBs – Anti-HBs – Total Anti-HBc + Anti-HBc IgM +	Acute infection (immunological window)	01 (0,9)
AgHBs+ Anti-HBs – Total Anti-HBc + Anti-HBc IgM +	Acute infection	01 (0,9)
AgHBs+ Anti-HBs + Total Anti-HBc –	Positive HBsAg marker [§]	01 (0,9)
AgHBs – Anti-HBs + Total Anti-HBc + Anti-HBc IgM +	Beginning of convalescent Phase	01 (0,9)
AgHBs+ Anti-HBs – Total Anti-HBc + Anti-HBc IgM –	Chronic infection	13 (11,6)
AgHBs – Anti-HBs – Total Anti-HBc + Anti-HBc IgM –	Positive anti-HBc marker, past infection [#]	15 (13,4)
AgHBs – Anti-HBs + Total Anti-HBc +	Previous contact	80 (71,4)

BRASIL (2008) e BRASIL (2016)

[#] Kwak e Kim (2014)

[§] described by Sitnik et al. (2004), Buti et al. (2005)

Source: Author

In relation to contact/infection status, 68(60.7%) were BB and 44(39.3%) were non-BB, with no statistically significant difference($p=0.101$). Male subjects had more contact/infection with HBV than did women ($p=0.000$). There was a statistically significant association between this status and the following risk factors related to habits and behaviors: use of illicit drugs ($p=0.025$) and illicit injectables ($p=0.024$), syringe and needle sharing ($p=0.034$). The only medical and therapeutic procedure associated with HBV infection/contact was blood transfusion before 1993 ($p=0.000$). (Table 3)

Table 3 – Risk factors associated with the status contact/infection with HBV

RISK FACTORS	CONTACT/INFECTION WITH HBV N=650		p
	YES n=112 n (%)	NO& n=538 n(%)	
Age			
Baby Boomer	68(60,7)	281(52,2)	
Non – Baby Boomer	44(39,3)	257(47,8)	0,101
Gender			
Male	57(50,9)	151(28,1)	0,000
Female	55(49,1)	387(71,9)	
Personal behavior and risk habits			
Tattoo and / or Piercing	16(14,3)	49(9,1%)	0,091
Unprotected sex	106(94,6)	518(96,3)	0,420
Illicit drugs	13(11,6)	31(5,8)	0,025
Injectable illicit drugs	5(4,5)	7(1,3)	0,040
Syringe / Needle Sharing	8(7,1)	16(3,0)	0,034
Sharing of personal hygiene items	45(40,2)	293(54,5)	0,006
Medical and therapeutic procedures			
Blood transfusion before 1993	12(10,7)	17(3,2)	0,000
Previous surgeries	77(68,8)	386(71,7)	0,524
Use of glass syringe	58(51,8)	253(47,0)	0,368
Dental procedures	102(91,1)	508(94,4)	0,153
Injectable vitamin complexes	21(18,8)	98(18,2)	0,868

Including Chronic Infection (13), Positive isolated anti-HBc marker(15), Prior Contact (80), in addition to the other 4 profiles

which add up for $n = 4$ (1 immunological window, 1 Infection by positive isolated HBsAg marker, 1 convalescent phase, 1 acute infection)

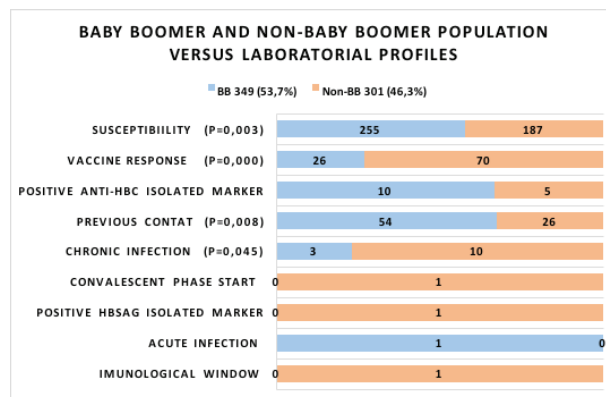
* Test used: Pearson's chi-square except for the variable injectable drugs (Fisher's Exact Test)

& Susceptibility profile and vaccine response

Source: Author

The most prevalent laboratory profiles that make up the contact/infection status are listed in Table 4, while graphic 2 shows all the status found in both BB and non-BB. In the previous contact profile, the BB generation presented a higher percentage than the non-BB generation. A difference was found with statistical significance ($p=0.008$) (67.5% vs 32.5%, respectively). The opposite was observed in the association with the serological profile of chronic infection (HBsAg+/Anti-HBc+/Anti-HBc IgM-/Anti-HBs-), in which individuals of the BB generation presented a significantly lower frequency than the younger group (23.1 % vs. 76.9%) ($p=0.045$). The prior contact laboratory profile was also significantly associated with females ($p=0.001$) and the profile of positive Anti-HBc isolated marker was associated with males ($p=0.001$). Regarding the risk factors related to personal conduct and habits, the use of tattooing/piercing was associated with the laboratory profile of chronic infection ($p=0.033$). There was a significant association between illicit drug use ($p=0.014$) and illicit injectable ($p=0.029$) and the laboratory profile of positive Anti-HBc isolated marker.

Graphic 2 – BB and non-BB population associated with hepatitis B laboratory profiles. The comparison of the laboratory profiles of BB and non-BB individuals suggests that BB had more previous contact with hepatitis B virus, in addition to a positive isolated anti-HBc marker. Non-BB presented higher frequencies of laboratory profiles of chronic infection and vaccine response.



Source: Author

Table 4 – Risk factors associated with laboratory profiles of contact / infection

RISK FACTORS	LABORATORY PROFILES OF CONTACT / INFECTION (TOTAL [#])					
	PREVIOUS CONTACT (n=80)		POSITIVE ISOLATED ANTI-HBc MARKER (n=15)		CHRONIC INFECTION (n=13)	
	n (%)	p	n (%)	p	n (%)	p
Age						
Baby Boomer	54(67,5)	0,008*	10(66.7)	0,308	3(23.1)	0,045[§]
Non – Baby Boomer	26(32,5)		5(33.3)		10(76,9)	
Gender						
Male	39(48,8)	0,001*	11(73.3)	0,001[§]	6(46.2)	0,269
Female	41(51,3)		4(26.7)		7(53.8)	
Personal behavior and risk habits						
Tattoo and / or Piercing	7(8,9)	0,712	4(26.7)	0,054	4(30.8)	0,033*
Unprotected sex	75(93.8)	0,273	14(93.3)	0,594	13(100)	1,000
Illicit drugs	7(8.8)	0,454	4(26.7)	0,014[§]	1(7.7)	0,602
Injectable illicit drugs	3(3.8)	0,177	2(13.3)	0,029[§]	0(0)	1,000
Syringe / Needle Sharing	4(5,0)	0,510	2(13.3)	0,103	2(15.4)	0,080
Sharing of personal hygiene items	29(36,3)	0,003	7(46.7)	0,676	7(53.8)	0,893
Medical and therapeutic procedures						
Blood transfusion before 1993	9(11,7)	0,001	1(6.7)	0,686	2(15.4)	0,113
Previous surgeries	53(66.3)	0,293	11(73.3)	0,856	11(84.6)	0,367
Use of glass syringe	45(56,3)	0,111	10(66.7)	0,141	2(15.4)	0,023[§]
Dental procedures	72(90.0)	0,109	14(93.3)	0,914	13(100)	1,000
Injectable vitamin complexes	12(15.0)	0,437	5(33.3)	0,130	4(30.8)	0,272

[#] Including Chronic Infection (13), Positive (15), Prior Contact (80), in addition to the other 4 profiles

which add up for n = 4 (1 immunological window, 1 Infection by positive isolated HBsAg marker, 1 convalescent phase, 1 acute infection)

Test used: Pearson's chi-square* and Fisher's Exact Test[§]

Source: Author

The comparison between the BB and non-BB populations regarding contact/infection status and possible associations with risk factors are presented in Table 5. There was a high frequency of non-BB participants who reported having a tattoo/piercing when compared to BB (25.0% vs 7.4%), with a statistically significant difference

($p=0.013$). For the other factors associated with habits and behaviors, no statistically significant difference was found. Among the participants in the BB population, there was a higher frequency of use of glass syringes compared to non-BBs (60.3% vs 38.6%), with $p=0.025$.

Table 5 – Risk factors associated with the contact/infection status of BB and non-BB participants

RISCK FACTORS	CONTACT/ INFECTION 112 n(%)		p
	BB 68(60,7)	Non-BB 44(39,3)	
Gender			
Male	37(54,4)	20(45,5)	0,354
Female	31(45,6)	24(54,5)	
PersonalHabitsandBehavior			
Unprotected sex	63(92,6)	43(97,7)	0,401
Sharing of personal hygiene items	25(36,8)	20(45,5)	0,360
Illicitdrugs (44)	8(11,8)	5(11,4)	1,000
Tattooand / orPiercing (65) (/1)	5(7,5)	11(25,0)	0,013*
Injectableillicitdrugs (12)	4(5,9)	1(2,3)	0,647
Medical andtherapeutic procedures			
Dental procedures	61(89,7)	41(93,2)	0,737
Previousurgeries	50(73,5)	27(61,4)	0,175
Use ofglassysyringe	41(60,3)	17(38,6)	0,025#
Bloodtransfusionbefore 1993 (/3)	7(10,6)	5(11,6)	1,000
Injectablevitamin complexes (/1)	14(20,6)	7(16,3)	0,572
Syringe / NeedleSharing	5(7,4)	3(6,8)	1,000

/n = Lost data

* Fisher's Exact Test

Pearson's Chi-square

Source: Author

Regarding medical follow-up due to diagnosis of hepatitis, 5(31.3%) BB and 15(71.4%) non-BB were found in the study population. Participants with isolated positive anti-HBc marker were informed of the need for further blood collection for HBV-DNA screening.

DISCUSSION

The main findings of this study showed an epidemiological profile of high prevalence (17.2%) of viral contact in the individuals evaluated, especially among participants over 51 years of age (BB). It should be noted that, although there was no age pairing, a balanced distribution was observed between BB and non-BB participants.

The prevalence found for contact/infection status (2.3% for HBsAg and 17.1% for Total Anti-HBc) in the total population was higher than those described in the national epidemiological reports. In 2011 in the Northeast Region, the prevalence was 11.7% for anti-HBc and 0.5% for HBsAg.⁽²¹⁾ In 2012, in the Northeast, the state of Bahia had the highest percentage (30.4%) of confirmed hepatitis B cases.⁽¹⁹⁾ In 2016 the city of Salvador had 2.52% from the total number of confirmed and reported cases of hepatitis B and the Northeastern region had 9,4 %, according to Notification of Injury Information System (SINAN).⁽²²⁾ The

findings of the present study confirm the importance of measures to prevent new cases and to identify and follow-up the individuals with a chronic infection profile.

Also in contact/infection status, the majority of participants had low-level schooling and family income. These findings coincide with the results of the last census of the Brazilian Institute of Geography and Statistics (IBGE) for the Northeast Region⁽²³⁾ and may reflect the lack of knowledge about the importance of vaccination or the impossibility of paying for the vaccine when it was only available in the private healthcare network.

These findings corroborate data found in Brazil, showing that 26% of the cases reported in official notifications presented low educational levels.⁽²²⁾ According to WHO⁽¹⁷⁾, the prevalence and incidence of HBV were 7.4 and 9.2 times higher respectively in low-income countries than in high-income countries.⁽¹⁷⁾ In the present study, 20.54% of the 112 participants categorized with contact/infection, reported as living in the "Subúrbio Ferroviário" neighborhood, one of the largest areas of economic fragility in Salvador previously identified as the second sanitary district of residence for reported cases of hepatitis in the period 2007 to 2012.⁽²⁴⁾

The serological panel of the different profiles was used to establish the three main statuses: HBV susceptibility,

hepatitis B vaccine response and contact/infection with HBV.^(20,22,25-28) The current study appears to be the first to perform serological evaluation in a population including the BB generation in a Brazilian metropolitan capital.

In addition, primary data were used in a sample that represents the user population of a SUS-accredited laboratory, resident in an important capital of the Brazilian northeast. Most studies published about the prevalence of contact with HBV use data from reported complaints or secondary data, which may often be compromised by underreporting and inconsistencies in registration.^(22,24,29)

The higher frequency of BB in the susceptibility status may have resulted from the gradual supply of the vaccine in the public health network through the National Immunization Plan (PNI) for special groups and different age groups, which, at first, did not include people of this generation.^(30,31) In 2015/2016, the offer was extended to all ages and conditions of vulnerability.⁽¹⁶⁾ The high cost of the vaccine, initially available only in the private network, may have hampered its acquisition by people with low family income and a lower level of education, which are striking characteristics of this population.

Negative serology for anti-HBs may also be due to individuals who did not complete the vaccination schedule or even non-responders to the vaccine. Considering that hepatitis B is sexually transmitted⁽³²⁾ and that in this study a high frequency of individuals with negative serological results for markers of infection or vaccination was observed, the susceptibility status among married or stable relationships may be a consequence of condom use or low viral circulation in this population.

The status of vaccine response was the least frequent in the total population studied, and of this group about 70% corresponded to younger (not BB) individuals, who probably had easier access to the vaccine. It is important to emphasize that the hepatitis B vaccine is part of the immunization programs of 179 countries including Brazil.^(33,34) Individuals of generation BB were more susceptible and less vaccinated than non-BB participants.

Most of the participants who had the status of contact/infection with HBV, belonged to the BB generation, as similarly reported in relation to hepatitis C, in the American BB generation. Both hepatitis can progress to hepatocarcinoma as individuals get older.⁽³⁵⁾ No specific studies have been found for hepatitis B in the BB generation. The serological profile of previous contact (considering that the infection was resolved) showed a higher prevalence in the population followed by the profiles of positive Anti-HBc isolated marker and chronic infection.

Generation BB individuals had more previous contact with HBV, but they had less chronic infection than the non-BB participants. Previous contact may be explained by changes in behavior with greater sexual freedom^(36,37), although unprotected sex was not a variable with a statistically significant association in this study.

The lower frequency of chronic infection means that the infection was resolved as indicated by the serological markers found in these individuals.⁽³⁸⁾ The fact that they

were infected in early life may have had favorably influenced the infection resolution.

Although the majority of the study population was composed by women, a greater proportion of men (11/15) were found in the profile of positive Anti-HBc isolated marker, and statistical significance was found between sex and this status suggesting that being a male is a risk factor for this profile. A similar finding was described in a study in the Cavunge District (Bahia / Brazil).⁽²⁶⁾ Occult infection was more frequently reported among men⁽³⁹⁾ and can be observed even in geographical areas with low endemicity⁽⁴⁰⁾, indicating the need for further studies on this clinical entity.

An association was found between the profile of chronic HBV infection in tattoo/piercing exposure. The association of this practice with hepatitis C has been described⁽⁴⁸⁾, and since contact with HBV occurs through the same parenteral route, these considerations may be extended to hepatitis B.

Few participants in this study population reported the use of drugs. However, an association between this variable and the profile of positive Anti-HBc isolated marker was observed. This finding corroborates the data found by authors who showed, after univariate analysis, that the history of illegal drug use was associated with HBV infection, among other factors.⁽⁴²⁾

In this study, we observed the association of blood transfusion with previous contact status with HBV. The prevalence of Hepatitis B was 1.8% among blood donors from Jacobina (Bahia-Brazil).⁽⁴³⁾ In Brazil, since 1989, it is mandatory to carry out tests to exclude hepatitis B and tests for the anti-HBc serological marker and transaminases are recommended for blood donors.⁽⁴⁴⁾

In the investigation of the relationship between being a member of the BB generation and HBV infection resulting from behavioral changes described in the literature, a comparison of the covariates of habits and conducts between BB and non-BB with contact/infection status was analyzed in this study and a greater frequency was found in the number of non BB individuals who reported having a tattoo/piercing when compared to BB. This result reflects the reality since this behavior (tattooing and piercing) has spread to younger generations.^(41, 45-47)

A higher frequency of glass syringe users was found in infected BB than among non infected BB. The use of this device, unrelated to drug abuse, was reported by almost half the study population, and half of the participants who presented contact/infection status reported this habit. This practice was fairly common some decades ago, including the initial period of the life of BB and this association is important because there are studies, described in the literature, demonstrating the relationship between the use of this device and hepatitis B.^(13,48) On the other hand, the low frequency of infection found in this population may have resulted from the efficacy of domestic boil sterilization that was performed or because there was less circulation of HBV at that time.

Regarding unprotected sex, widely reported as a risk factor⁽⁴⁹⁾, almost all participants, both elderly and young, reported having had sexual intercourse without using a condom. However, it should be taken into account that the interviews with a personal approach to habits and behaviors are subject to the bias of measurement and memory because of the embarrassment caused by the question and lack of memory of the interviewee, and may lead to responses that do not reflect the truth. Another possibility is that there has been low viral circulation at the time, considering that it is a sexually transmissible infection.

There was no association with previous surgeries, syringe or needle sharing in injections, dental treatment and use of injectable vitamin complexes with the different contact status with HBV.

CONCLUSION

In conclusion, we found a high prevalence of viral contact in the studied population, and the majority of these corresponded to individuals over 51 years of age (BB). An association was found being found between the use of glass syringe and the BB generation. The HBV susceptibility status observed in the majority of the studied population indicates absence of vaccination and contact with virus. The profile of positive Anti-HBc isolated marker was associated with males.

These findings suggest the need for greater attention from public health services to the Baby Boomer generation, a population segment with increasing life expectancy in recent years. The expressive predisposition to HBV infection found in the current study suggests the need for greater surveillance and educational programs for this exposed population.

ACKNOWLEDGMENTS

The authors thank all the patients who agreed to be included in this study for their cooperation. Strategic and financial support from the Laboratory of Immunology and Molecular Biology (ICS-UFBA), NEC-BA (UFBA), Ambulatory of Gastrohepatology (UFBA), PIBIC-UFBA.

FINANCIAL SUPPORT

This study was funded by the Laboratory of Immunology and Molecular Biology (ICS-UFBA), supported by the NEC-BA (UFBA) and Ambulatory of Gastrohepatology (UFBA), donors had no role in the study design, data collection and analysis, decision publication or manuscript preparation.

AUTHORS' CONTRIBUTIONS

JMS, RES, FAB contributed to the acquisition and the interpretation of the data and wrote the the manuscript. JES contributed in the recruitment of the patients and first analysis patients data. RM, RP, MIS critically revised the paper and approved its final version. SMF contribut-

ed to the interpretation critically revised the paper and approved its final version. SCT contributed to guide the statistical analyses and approved its final version.

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Submetido em: 13/08/2018

Aceito em: 13/02/2019