



Estimating the prevalence of Hepatitis B Virus infection among age groups of the Libyan population in Tripoli

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Abstract:

Occult hepatitis B (OBI) poses a significant problem of its transmissibility and prevalence among the community layers; it is considered one of the main causes of hepatic crises including cases of liver cirrhosis and even hepatocellular carcinoma (HCC). This study aims to determine the age group of young people who are most likely infected, which could be used as an indicator to highlight the extent of this problem in the country. Data on HBV patients were gathered from the NCDC, for 36 months from January 2019 to December 2021, was performed the diagnostic test; Enzyme-Linked Immunosorbent Assay (ELISA) on a total number of 3396 participants. As well the data were also analyzed using SPSS version 22. Out of the total of 3396 sample records, about 1681 samples were free of hepatitis B infection (49.50%), and 1715 were positive (50.50%). The number of males infected in the study population was generally 1266, (37.28%) of the total number of 3396 participants in the examination in contrast to 449 female cases (13.23%), with a positivity ratio of 2.82:1. It was the highest frequency of infection with hepatitis B in an age ranging between (31_40), with an average prevalence rate of (33.68%) in the study population. In conclusion, a high rate of hepatitis B positive was identified among the samples participating in the examination, with the highest frequency of infection in the middle age stage. There are also significant gender differences in the burden of hepatitis B virus. A relatively high percentage, requiring further studies and research.

Keywords: HBV Prevalence; OBI; ELISA; Blood transfusions.

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تقدير مدى انتشار عدوى فيروس التهاب الكبد (B) بين الفئات العمرية للسكان الليبيين في طرابلس

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المخلص

يشكل التهاب الكبد الوبائي الخفي (OBI) مشكلة كبيرة تتمثل في إمكانية انتقاله وانتشاره بين طبقات المجتمع؛ ويعتبر أحد الأسباب الرئيسية للأزمات الكبدية بما في ذلك حالات تليف الكبد وكذلك سرطان الخلايا الكبدية (HCC). تهدف هذه الدراسة إلى تحديد الفئة العمرية للشباب الأكثر عرضة للإصابة، والتي يمكن استخدامها كمؤشر لتسليط الضوء على حجم هذه المشكلة في الدولة. تم جمع البيانات عن مرضى فيروس التهاب الكبد B من المركز الوطني لمكافحة الأمراض، لمدة 36 شهراً من يناير 2019 إلى ديسمبر 2021، تم إجراء الاختبار التشخيصي؛ فحص الامتصاص المناعي المرتبط بالإنزيم (ELISA) على إجمالي عدد 3396 مشاركاً. كما تم تحليل البيانات باستخدام برنامج SPSS الإصدار 22. من إجمالي 3396 عينة مسجلة، كانت حوالي 1681 عينة خالية من الإصابة بالتهاب الكبد الوبائي بنسبة (49.50%)، و1715 عينة إيجابية بنسبة (50.50%). بلغ عدد الذكور المصابين في مجتمع الدراسة بشكل عام 1266 (37.28%) من إجمالي عدد المشاركين في الفحص البالغ عددهم 3396 مقابل 449 حالة للإناث (13.23%)، بنسبة إيجابية 2.82:1. وكانت أعلى نسبة إصابة بالتهاب الكبد الوبائي (ب) في الفئة العمرية ما بين (31_40) بمتوسط نسبة انتشار (33.68%) في مجتمع الدراسة. نستنتج من ذلك أنه تم تحديد نسبة عالية من إيجابيات التهاب الكبد الوبائي (B) بين العينات المشاركة في الفحص، وكانت أعلى نسبة إصابة في مرحلة منتصف العمر. كما هنالك أيضاً اختلافات كبيرة بين الجنسين في عبء فيروس التهاب الكبد (B). وهي نسب عالية نسبياً، وتتطلب مزيداً من الدراسات والأبحاث.

الكلمات المفتاحية: انتشار فيروس التهاب الكبد الوبائي B، عدوى فيروس التهاب الكبد الخفية، فحص الامتصاص المناعي المرتبط بالإنزيم، عمليات نقل الدم.

Introduction

Hepatitis B viral (HBV) infection is a significant public health issue worldwide. According to national and international health organizations, there are around 300 million HBV infections globally, resulting in nearly 800,000 deaths [1, 2]. An estimated 57% of cirrhosis cases are due to HBV infection [3]. In 2019, the World Health Organization (WHO) estimated that about 296 million people were living with chronic HBV infection; besides, around 1.5 million new infections each year [4]. According to the latest estimates from the Global Burden of Disease Survey, viral hepatitis is responsible for approximately 1.5 million deaths per year; this is comparable to the annual deaths from HIV/AIDS, malaria, and tuberculosis: 1.3 million, 0.9 million, and 1.3 million respectively [5]. Nguyen et al., (2020) Pointed out that the prevalence of chronic HBV infection varies greatly in different parts of the world, where the age and the time of infection are associated with the endemicity of the HBV infection in areas, categorized as high, intermediate or low in endemicity [6]. However, most of the areas infected with HBV are in Asia and the Western Pacific [7]. The recent reports of the World Health Organization in 2023s indicated that the epidemiological of chronic HBV infection was highest in the Western Pacific Region: 116 million were infected with chronic hepatitis B, followed by the African Region with 81 million people infected. In addition to sixty million people were infected in the Mediterranean Region, 18 million in the South-East Asia Region, 14 million in the European Region, and just 5 million in the Region of the Americas [8]. From 2011 to 2019, the rates of reported cases of acute hepatitis B steadily increased among persons aged 40_49 and 50_59 years [9]. Also, since 2019, the proportion of children less than five years old chronically infected with HBV went down from around 5% in the pre-vaccine period starting intensely and effectively in the world from the 1980s to the early 2000s; it then dropped to just below 1% [8]. In 2020, the rates declined in all adult age groups and remained at 0.0 cases per 100,000 population among those 0_19 years of age while, the highest rates were among persons between 40_49 years old (1.7 cases per 100,000 population), 50_59 years (1.2 cases per 100,000 population), and 30_39 years (1.0 cases per 100,000 population [9]. With implementation of a mass HBV immunization program, which has been recommended by WHO since 1991; was dramatically decreased the prevalence of HBV infection and HCC in many countries [8].

Viral hepatitis is a global healthcare challenge; its prevalence has increased with unchecked conditions in areas like sub-Saharan Africa [10]. The dominance of acute and chronic HBV infections in this area remained to be widely documented recently [11]. According to Saaed and Ongerth (2023), the African migrants in sub-Saharan particularly were mostly infected by HBV [10]. The hepatitis B virus can be transmitted vertically (from mother to child) or horizontally (through needle stick injury, body fluid splashes, and sexual contact, especially among those who have had multiple sexual encounters), by the blood and body fluids of the infected people [12]. Up to 90% of the people who developed HBV as adults experience self-limiting HBV infection. The hepatitis B virus (HBV) infection has a negative period (HB antigen and anti-HB negative) at the onset of the infection. There is also the so-called occult HBV infection (OBI), where HBsAg is negative whereas the serum or liver DNA is positive [13]. These two factors make HBV the most common virus, most commonly transmitted through blood transfusions, as the risk of HBV infection from blood transfusions varies by HBV endemic area and pre-transfusion testing [14]. Although the incidence has significantly decreased as a result of the systematic screening of the blood products before transfusion, HBV can still be transmitted through blood transfusions [12]. While, in high-income countries, both molecular tests (DNA) and serological tests (HBsAg, anti-HBc) are used to screen blood before transfusion [15, 16].

Material and methods

Ethical approval: The study was conducted by the national ethical guidelines with informed consent; it is approved by the ethical review committee of the National Center for Diseases Control - Tripoli Libya. Data patient confidentiality was maintained by avoiding personal identity and anonymity of the personal data records, whereby just the patient's data were recorded such as age, sex, and place of residence. **Study Population and Sample Design:** This cross-sectional study is designed to assess the prevalence rate of HB-V infection at Tripoli Libya from 2019 to 2021. A total number of 3396 individuals comprising males and females were screened to be tested for HBsAg, at the Department of Virology, the Libyan National Center for Disease Control-Tripoli Libya during the study period. The bio-data of the participants were grouped as follows: 0_10 years, 11_20 years, 21_30 years, 31_40 years, 41_50 years, 51_60 years, and ≥ 60 years. The individuals tested were those without any symptoms; those with symptoms related to infected people and individuals having symptoms but were not related to previously infected people. Data were collected from January to December months for three years. **Diagnostic Test and Blood Screening:** 5 ml of venous blood was taken from each patient especially via venipuncture and it was collected in clean sterile tubes for HBV screening. The samples were branded by a code to avoid misunderstanding the results. The tests were carried out in accordance with the blood banks and kits manufacturers' recommendations; they were performed as always on the same day. The mandatory screening tests detect HBV applying ELISA test for HBsAg. Anti-HBV coreIgM was quantitatively detected using a prepared anti-HBcIgM kit by DIA. PRO Diagnostic Bio-probes Srl Via Columellan^o was performed on 31st 20128, Milan-Italy. **Statistical analysis:** In this study, Version 21 of the Statistical Package for Social Sciences (SPSS) software was used to analyze the data.

Results and discussion

Assessment of the prevalence rate of HB-V infection:

A total of 3396 samples underwent the HBsAg testing using the Enzyme-Linked Immunosorbent Assay (ELISA) to produce the results for this study as demonstrated in Table (1), where 1715 were marked HBV-positive over three years: 694 were infected in 2019, 699 in 2020, and just 322 affected in 2021.

Table. 1: Prevalence rate of the population infected with lenceofviral hepatitis B in Tripoli, Libya

The number of patients infected and non-infected with hepatitis B				
Human Immunodeficiency Virus	Year of analysis			Total
	2019	2020	2021	
Non-Infected	692	687	302	1681
Infected	694	699	322	1715
Total	1386	1386	624	3396

A comparison of the number of males and females with HBV infection reveals that in 2019, there were 509 men and 185 women infected, whereas in 2020, there were 512 men and 187 women afflicted. In contrast, only 245 males and 77 females contracted HBV in 2021, which was the year with the fewest cases as shown in Table (2). The study group included 2483 (73%) males and 913 (27%) females. The number of infected males was 1266 representing (73.82%), and of females was (449) representing (26.18%), of the total number of infected cases (1715). While in general, in the study population, out of a total of 3,396 screening participants, the number of infection cases were 1266 cases in males (37.28%), compared to 449 cases in females (13.23%), with a positivity ratio of 2.82:1.

Table 2: Assessment of prevalence rate of lenceofviral hepatitis B between males and females in Tripoli, Libya

Year of analysis		Sex of Patients		Total
		F	M	
2019	Non-Infected	193	499	692
	Infected	185	509	694
	Total	378	1008	1386
2020	Non-Infected	193	494	687
	Infected	187	512	699
	Total	380	1006	1386
2021	Non-Infected	78	224	302
	Infected	77	245	322
	Total	155	469	624
Total	Non-Infected	464	1217	1681
	Infected	449	1266	1715
	Total	913	2483	3396

The results outlined in (Fig. 1) display the ages of the infected patients from three to ninety-nine years; the majority of the cases were in a range of (31_40) old, with a generally average age of all the infected at 41. Also, the comparison of the age groups of males and females with HBV infection shows, that the infection incidences high for those aged between (32_50) in cases of females with a median of 38 years old, while in males, there were high frequencies in ages between (35_52) by a median age of 42.

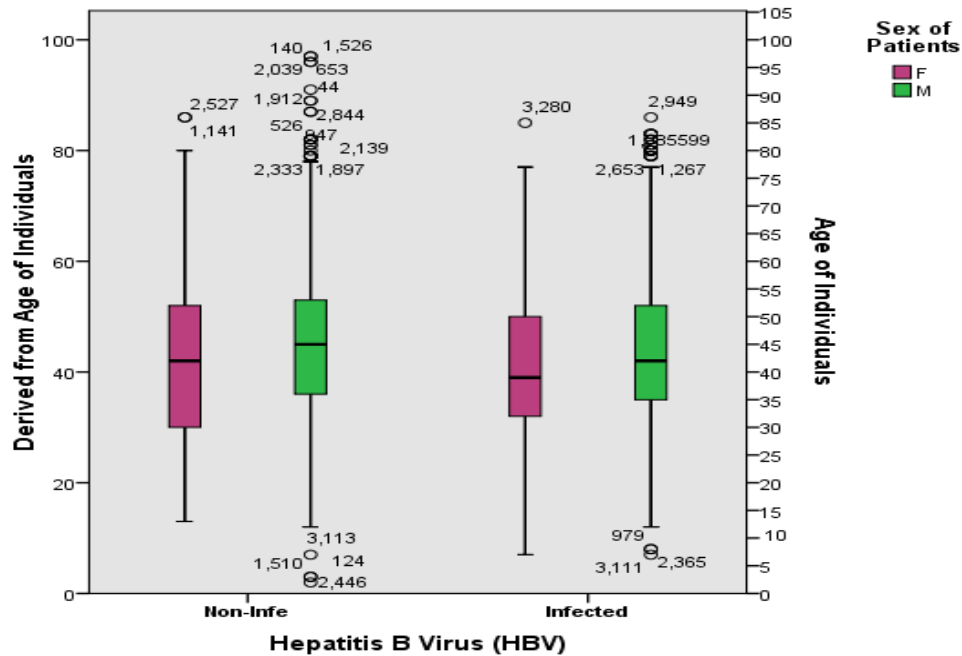


Figure 1: The average age of incidence with lenceofviral hepatitis B in the cases of males and females.

The researchers then evaluated the prevalence of HBV infection within the study population; the age range is illustrated in Table (3), which is the main goal of the current study. The results recorded a higher proportion of individuals infected with HBV in the age group of (31_40). In 2019, there were 265 individuals infected (38.18%), whereas in 2020, 250 cases (35.77%) were reported. In 2021, there were just 83 cases in this range of age with a percentage of (27.1%). Young age group (21_30) also recorded a low number of cases. In 2019, there were 69 infected by (9.94%) in this age range, 71 infected (10.10%) in 2020, and 60 infected in 2021 with a percentage of (18.63%) at this age group. The children of age groups (0_10) and (11_20), exhibited the lowest infection rate. The prevalence rate in 2019 and 2020 was at a ratio of (0.14% and 0.85%), in contrast, there was a slight increase in the infection level at 2021 with a percentage of (0.93% and 4.66%).

This is followed by a significant increase in infections in patients aged between (41_50). In 2019, there were 185 cases of injuries represented (26.66%) compared to 166 cases in 2020 represented by (23.75%). There were 75 infections in 2021 with a percentage of (23.29%). As for the age range (51 to 60), there was a low number of infections. In 2019, there were 97 cases (13.98%), 124 infected (17.74%) in 2020, and 55 cases with a percentage of (17.08%) at this age in 2021. The old ages >60 of (61_70), (71_80) and (81_90) age groups recorded lower levels of infection rates in 2019, 2020 and 2020 respectively by (10.23%, 11.59% and 8.39%).

Table 3: Assessment of the prevalence rate of lenceofviral hepatitis B among the age groups of Libyan Individuals, Tripoli

Age of Individuals		Frequencies		Total
		Non-Infected	Infected	
2019	1_10	0	1	1
	11_20	8	6	14
	21_30	101	69	170
	31_40	154	265	419
	41_50	204	185	389
	51_60	148	97	245
	61_70	43	54	97

	71_80	25	14	39
	81_90	9	3	12
	Total	692	694	1386
2020	1_10	0	1	1
	11_20	7	6	13
	21_30	95	71	10
	31_40	147	250	404
	41_50	192	166	361
	51_60	174	124	298
	61_70	39	53	92
	71_80	26	21	44
	81_90	5	6	11
	91_100	2	1	3
	Total	687	699	1386
2021	1_10	1	3	4
	11_20	8	15	23
	21_30	48	60	108
	31_40	90	87	177
	41_50	68	75	143
	51_60	63	55	118
	61_70	15	19	34
	71_80	8	4	12
	81_90	1	4	5
	Total	302	322	624

Discussion:

The present study investigated the prevalence of hepatitis B infection among individuals attending the National Center for Disease Control in Tripoli, Libya. The prevalence of occult hepatitis B infection (OBI) varies among countries around the world, depending on the dominating level of HBV [17]. The rate prevalence of HBV-positive in this study was (50.50%) as indicated in Table (1), which is considered high according to the researchers' beliefs and reviews of the previous studies on the prevalence of hepatitis B infection in Libya. Recently, Saaed and Ongerth (2023) [10] revealed of the spread of infection among the African immigrants from Sub-Saharan to southern Libya at Kufra ; their findings revealed in 2019, that (23.4%) of the migrants were positive for HBV. Therefore, there is an increase the risk of incidence among young people in the Libyan population, due to a lot numbers of African migrant groups with different social and religious cultures in the labor market. This highlights the necessity to take action to deal with migrants and to raise awareness about the risks of the virus transmissions and outbreaks among the local population. At the procedural level, the control of the prevalence of viral hepatitis is a global health security challenge in some areas like sub-Saharan, where African migrants carry high rates of HBV infection. The total number of infected people during the three years of the study (2019 to 2021) was 1715. This is close to the number of infections recorded in the recent study conducted by Dow et al in Libya (2020) [18], where 1873 samples were diagnosed as positive for hepatitis B virus in the survey (from 2015 to 2018). Also, the finding agrees with those studying the prevalence rate of HBV infection in the state of Egypt, as indicated by El-Ghitany et al (2022) [19], the majority of the participants in the health survey tested positive at least for one of the three screening tests: (anti-HAV IgG, anti-HBsAg, anti-HBs IgG) by a rate prevalence of (69.5%).

The current study displayed significant gender differences in the burden of hepatitis B virus as indicated in Table (2), which confirmed that men were more likely to be infected with hepatitis B than women. By comparing the incidence of infection between genders at the level of the number of infected people, it was found that of the total number of infected cases (1715), about 1266 were males (73.82%) and 449 were females (26.18%). This is in line with study of Khan et al (2011) [20], where the males were observed to be more frequently infected by (68.15%) as compared to the females (31.85%), with a positivity ratio of 2.14:1. Similarly, it was confirmed that there was an increased number of males infected in the study population: generally, 1266 males were infected represented by (37.28%) of the total number 3396 participating in the examination in contrast to 449 female cases by (13.23%), with a positivity ratio of 2.82:1. These findings are consistent with an earlier study conducted by Kolou et al (2017) [11], where the prevalence rate in the study population was significantly higher in men (25.00%) than in women (14.80%), with a positivity ratio of 1.70:1. As well, this finding was confirmed by other studies, undertaken by El-Ghitany (2022) [19] in Egypt, Wang et al (2019) [21] in China, and Lakoh et al (2021) [22] in Sierra Leone. Also, it is in agreement with a study carried out by Apercu et al (2018) [23] in Uganda, exploring

the high prevalence rates of hepatitis B virus in males and confirming a higher proportion of HBV infections in men generally; besides the study explained, men had a higher risk of Hepatitis B infection compared to women for many reasons, that one of the most important reasons could be attributed to risky sexual behaviours.

As indicated in Table (3) and Figure (1) in this study, the age parameter affected the prevalence of hepatitis B infection in the study group. The highest frequency of infections of infected people was found in the ages (31 and 40) in 2019, 2020 and 2021 by a ratio of (38.18%, 35.77% and 27.1%) respectively with an average prevalence rate 35.10% of total number cases (1715). This is confirmed by [9] and as reported in 2020 by the National Center for Health Statistics, whereby the rate of the newly reported cases of chronic hepatitis B was the highest among persons aged 30 and 39 accounting for 46% of all chronic hepatitis B cases registered during 2020. It was also reported by the US Department of Health and Human Services. In contrast, this finding is not consistent with an earlier study finding such as that reported by Kolou et al (2017) [11], which only recorded 21.67% cases in age groups of (30_39) years, as well as that of Khan et al (2011) [20], where the prevalence rate of those infected with lenceofviral hepatitis B was 23.83% in age group (31- 40).

In the younger age group (21_30) in the present study, 9.94%, 10.10% and 18.63% were recorded respectively during the three consecutive years of the research, with an average prevalence rate of 11.66% in total number of infected cases (1715). Thus, this percentage is not consistent with that reported in the previous study of Kolou et al (2017) [11], where the highest prevalence rate was recorded (26.33%) in age groups of (20_29). Also, Khan et al (2011) [20] study demonstrated the highest frequency of infection found in the individuals aged (21_30) by (34.93%). Infections being higher in the young may be attributed more to this age group interaction in society, as compared to children and aged persons; thus, they have greater prospect exposure to infection. Specially, there are some wrong or bad habits that they fall into, like shaving and applying dental procedures without control and protection, blood transfusion and the use of reused injections to drug, also, a high trend of sharing personal things between young people.

Children and adolescents less than 20 years old (11_20) in the current research findings showed the fewer infection rates, with an average prevalence rate was 1.60% of infected samples (1715) during the research period. The infection prevalence was (0.86%) in 2019 and 2020 and (4.66%) in 2021. This finding is not exactly consistent with that of Khan et al (2011) [20], which recorded a nearly high rate of (13.39%) concerning the category of age group (11_20) when comparing the incidence of adolescents, among age groups (11_20) and (21_30). According to the regression model, being infected by hepatitis B in 2019, 2020 and 2021 indicated: 11.5, 11.8 and 4 times higher in the age group of (21_30) years than in the (11_20) year's age group. This finding is not in line with that of Damien et al., (2021), which indicated that being infected by hepatitis B was 4.32 times higher in the young age group of (15_19) than in the group over twenty years old. On the other hand, the recorded cases of hepatitis B virus in the young child group in this research showed the prevalence rate is very low, where the infants and babies aged (0_10) revealed very few infection rates in 2019 and 2020 represented by (0.14%) and (0.93%) in 2021 with an average prevalence rate of 0.29% in total number of infected cases (1715). This result does not converge with the results of Khan et al (2011) [20], which represented (1.49%) in this age group. And yet it represents a serious risk posed by infected pregnant women; with transmitted of infection to the infant during childbirth. Generally, this is not a good indicator for those concerned with children's health in the country based on what is published by the National Center for Health Statistics, and the US Department of Health and Human Services, at its report in 2020 [9]. It is also, infection of HBV may be developed without post-exposure immunoprophylaxis to chronic HBV infection at approximately 40% of the infected infants born to infected mothers, this would likely lead to about a quarter of them dying from chronic liver disease [2].

In contrast, a higher proportion of those infected with HBV in the age range of (41_50), was recorded during the research period, constituting ratios of 26.66%, 23.75% and 23.29% respectively with an average prevalence rate of 24.84%. This finding is also confirmed by the National Center for Health Statistics, and the US Department of Health and Human Services [9], where the newly reported cases of chronic hepatitis B during 2020 in the age group (41_50) was the highest. As well, this finding is not in line with that of Khan et al (2011) [20], which recorded just of (16.13%) in this age group. As for the age group (51_60) in this research, a low number of injuries was recorded (13.98%, 17.74% and 17.08%) respectively in a period of study, with an average prevalence rate of 16.09% of the infected cases. The present research results were very close to Ahmed et al (2020) [24], which reported a similar percentage distributed between males and females. Whereby the incidence rates recorded were (9.52%) in females and (8.5%) in males in this age group. In contrast, this finding did not agree with Khan et al (2011) [20], which showed an infection rate just of (6.08%) in age groups (51_60). There were declines in the rates of infection in the findings corresponding with an increase in age: old>60 years (61_70, 71_80 and 81_90); which fewer infection rates were recorded: 10.23%, 11.59% and 8.39% respectively in period of study, with an average prevalence rate of 10.44% of infected cases. This percentage is considered relatively high when compared

with that of Khan et al (2011) [20], which recorded the lowest rate of infection (1.65%) in this group age. The prevalence percentage of hepatitis B virus incidence is considered roughly high in the elderly recently. This may be attributed to some wrong eating habits since the simple lifestyle was devoid of restrictions and protection, as well as to the absence of the concept of prevention, the prevalence of illiteracy, and the lack of knowledge and nutrition awareness.

Conclusion

To sum up, the data presented in this study provides preliminary information about the age effect on the prevalence rate of infection with lenceofviral hepatitis B among Libyan patients in Tripoli for three consecutive years. The research findings highlighted the importance of assistance and guidance to the individuals, the majority of whom are unable to access life--saving tests and treatments, and the significance of raising the individuals' awareness of the complications resulting from neglect, which aggravates the situation by progressing chronic liver diseases, cancers and deaths. There is also a dire need to enhance awareness by adhering to HBV vaccination to avoid the prevalence of OBI and the risks it poses. As well as, the hepatitis B vaccine should be administered to all unvaccinated adults from 30 years old to 60, to those that were not targeted for vaccinations at a previous stage.

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