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Epidemiological Assessment of Hepatitis C Virus Seroprevalence Among Screened Populations in Arar City, Northern Saudi Arabia

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ABSTRACT

The Hepatitis C Virus (HCV) infection remains a significant global public health issue, despite advancements in prevention and treatment, highlighting the need for reliable local epidemiological data to support elimination strategies. This study aimed to assess the seroprevalence of HCV infection among individuals tested in Arar City, Northern Saudi Arabia. A descriptive cross-sectional study employed standard HCV screening records from public healthcare facilities, obtaining serological test results and demographic information from institutional laboratory and hospital information systems. Descriptive statistical analysis was employed to evaluate HCV seroprevalence and characterize the screened population. A total of 384 individuals participated, consisting of 57.0% females and 87.8% Saudi nationals, primarily including young to middle-aged adults. Of the persons checked, 383 (99.7%) tested negative for HCV, while one individual (0.3%) tested positive, indicating a negligible seroprevalence in Arar City. The results indicate the effectiveness of national prevention, screening, and blood safety programs in Saudi Arabia; however, the rise of new cases underscores the need for sustained systematic screening, adherence to stringent laboratory diagnostic standards, and improved local surveillance to support ongoing progress towards HCV elimination.

Keywords: Hepatitis C virus, Seroprevalence; Screening, Epidemiology, Saudi Arabia, Arar City.

INTRODUCTION

Hepatitis C virus (HCV) infection is still a big public health problem around the world. About 58 million people have a chronic HCV infection, and about 1.5 million people get infected every year (WHO, 2024). The virus leads to cirrhosis, liver failure, and hepatocellular cancer. The "silent epidemic" of hepatitis C doesn't usually cause signs until it is already very advanced. Finding a virus early helps to lower the number of infections and speed up the healing of patients. HCV sensitivity testing has completely changed how we diagnose and treat HCV, allowing for earlier identification and treatment of the disease (Alzahrani, 2021). Even though there are very good direct-acting antiviral drugs, the global impact of HCV continues mostly because many infections go undiagnosed, especially in people who don't have symptoms and groups that don't have easy access to regular screening (WHO, 2023).

Serological screening is very important for finding HCV infections early. It is also a key part of methods for monitoring, preventing, and getting rid of the virus. Enzyme-linked immunosorbent assays (ELISA) and other antibody-based screening tests are very sensitive, easy to use, and cheap, which makes them popular for population-level screening (Polaris Observatory HCV Collaborators, 2017). But things like the population's risk profile, how many tests are done, how well the lab works, and how common the disease is in the area can all affect how

epidemiologists read seroprevalence data. So, to get a true picture of the HCV infection problem and to plan specific actions to protect public health, it is very important to do disease-specific studies that consider the local situation.

In Saudi Arabia, a lot of work has been done to improve viral hepatitis surveillance and screening programs. This is in line with the World Health Organization's goal of making hepatitis C not a public health danger by 2030 (WHO, 2024). National estimates show that HCV is less common in the United States than in other countries, but it still varies by area (Saudi Ministry of Health [MOH], 2022). Northern Saudi Arabia, including Arar City, is a different place where population makeup, access to healthcare, and referral trends may affect how well screening works. Even though healthcare facilities do regular and opportunistic HCV screenings, there is still not a lot of epidemiological data from this area.

It is especially important to know how many people in a screened community have HCV in places where the disease is not common. This is because the screening tests are more likely to be accurate, and there are fewer false positives (people who don't have the disease but test positive) (Alter, 2007). Also, lab-based screening data gives us a lot of information about how well diagnostic paths and screening methods work. This kind of proof is very important for making screening algorithms better, making sure that lab tests are accurate, and making it easier to get people to confirmatory testing and treatment services.

There isn't a lot of epidemiological data from Northern Saudi Arabia, so this study wants to look at how common Hepatitis C Virus infections are in people who were checked in Arar City. This study looks at healthcare screening statistics to help people better understand how many people in the area have HCV. It also wants to help plan screening and prevention programs in the region that are based on evidence.

LITERATURE REVIEW

Seroprevalence studies of screened populations are essential epidemiological instruments for evaluating the prevalence of HCV infection. Antibody-based assays, such as enzyme-linked immunosorbent assays and chemiluminescent immunoassays, are extensively utilized for large-scale screening due to their superior sensitivity and practical implementation. Anti-HCV seropositivity indicates exposure rather than active infection, requiring confirmatory testing with HCV RNA or core antigen assays to determine current infection status (WHO, 2025). In low-prevalence environments, like numerous high-income nations, the analysis of seroprevalence data is further confounded by diminished positive predictive value and an increased incidence of false-positive screening outcomes.

The epidemiology of HCV infection in Saudi Arabia has significantly changed during recent decades. Previous studies indicated modest prevalence rates, characterized by significant regional and demographic diversity (Abdo et al., 2012; Madani, 2007). Recent evidence indicates that Saudi Arabia is now categorized as a low-prevalence country, primarily due to advancements in blood safety, infection control measures, and increased availability of antiviral treatments (Saudi Association for the Study of Liver Diseases and Transplantation [SASLT], 2024). Nonetheless, variation remains among locations and screened groups, highlighting the necessity for regional epidemiological evaluations.

The majority of data regarding HCV seroprevalence in Saudi Arabia originates from screened populations, specifically blood donors and individuals participating in premarital screening. Studies on blood donors typically indicate low seroprevalence rates, frequently around 1%, although these values may underrepresent actual community prevalence due to the healthy donor effect (Alsughayyir et al., 2022; Alqahtani as al., 2021). Likewise, premarital screening initiatives have exhibited markedly decreased HCV positivity rates in recent years, especially in comparison to hepatitis B virus infection (Al Zuayr et al., 2024; Alzahrani et al., 2024). Although these databases offer significant surveillance insights, they may inadequately represent infections within marginalized or high-risk populations.

Geographically, there is a scarcity of peer-reviewed epidemiological data for Northern Saudi Arabia, especially Arar City. Previous research in this region has predominantly concentrated on awareness and understanding of viral hepatitis, rather than on laboratory-validated seroprevalence estimations. Due to regional disparities in healthcare availability, demographic composition, and screening methodologies, applying national or central-region numbers to the Northern Borders region may not adequately represent local epidemiological trends.

Comprehending HCV seroprevalence in screened populations in Arar City is essential for guiding regional public health initiatives, enhancing screening methodologies, and fortifying diagnostic processes. A localized epidemiological evaluation can furnish evidence regarding screening efficacy, demographic distribution of seropositive individuals, and any deficiencies in confirmatory tests and care linkage. This research is crucial for advancing national hepatitis elimination objectives and guaranteeing equitable access to preventive and treatment services throughout all regions of Saudi Arabia.

METHODOLOGY

Research Design

A descriptive cross-sectional study methodology was adopted to ascertain the prevalence of Hepatitis C Virus (HCV) infection among screened persons in Arar City. This strategy proved suitable for assessing HCV seroprevalence within a specified population at a particular moment, without altering study factors. The cross-sectional method facilitated the evaluation of screening results as they transpired inside standard healthcare environments, thereby offering a precise depiction of the epidemiological impact of HCV during the study duration.

The prevalence of HCV infection was assessed using serological screening results, principally anti-HCV antibody testing, documented in laboratory databases. Descriptive statistical analysis was utilized to compute prevalence rates and to summarize the demographic characteristics of the screened sample. This research design established a comprehensive epidemiological framework for assessing HCV seroprevalence in Arar City and for guiding local public health planning and screening initiatives.

Research Setting

The study was performed at Arar City, situated in the Northern Borders Region of Saudi Arabia, which functions as a healthcare center for the adjacent area. The study environment included prominent public healthcare organizations engaged in Hepatitis C Virus (HCV) screening and diagnosis, including tertiary and secondary hospitals, the Northern Border Regional Laboratory, and the Central Blood Bank. These facilities constitute the fundamental elements of the public healthcare system tasked with HCV identification and management in Arar City.

All participating institutions implement established HCV screening and diagnosis programs that include standardized serological and molecular testing methodologies, such as enzyme-linked immunosorbent tests and confirmatory molecular approaches. The incorporation of various healthcare facilities guaranteed coverage of a wide range of screened individuals and improved the representativeness of prevalence estimates at the municipal level.

Research Instrument

Data for this study were obtained using a structured data collection instrument designed to support the assessment of Hepatitis C Virus (HCV) screening outcomes and diagnostic practices in Arar City. For the purpose of estimating HCV prevalence, the instrument was used to systematically capture standardized information related to screening processes and laboratory testing within participating healthcare facilities.

The instrument was developed based on a review of relevant scientific literature and international recommendations for HCV screening and diagnostics, ensuring alignment with accepted laboratory standards. It included structured items that allowed for consistent data capture across institutions, facilitating comparability of screening outcomes.

Data Collection

Data were collected using a cross-sectional approach from routine Hepatitis C Virus (HCV) screening records obtained from selected public healthcare facilities in Arar City. Laboratory data included results of serological HCV screening tests, along with relevant demographic information of screened individuals, as documented in institutional laboratory and hospital information systems. Data collection was conducted over a defined study period to ensure consistency and to provide a representative snapshot of HCV screening outcomes.

All data were extracted according to standardized protocols to ensure accuracy and completeness. Only records meeting predefined inclusion criteria were included in the analysis. Collected data were anonymized prior to analysis to maintain confidentiality. This systematic approach enabled accurate estimation of HCV seroprevalence and facilitated comparison of screening outcomes across participating healthcare facilities in Arar City.

Data Analysis

Data were inputted and analyzed utilizing suitable statistical tools. Descriptive statistical methods were utilized to describe the demographic parameters of the screened population and to estimate the prevalence of Hepatitis C

Virus (HCV) infection, represented as frequencies and percentages. The seroprevalence of HCV was determined as the ratio of people with positive screening results to the total number of participants screened.

Stratified analyses were performed to investigate prevalence patterns among demographic subgroups and healthcare facilities when relevant. Results were displayed in tables and figures to enhance clarity of interpretation. This analytical method guaranteed precise assessment and unambiguous representation of HCV prevalence in Arar City.

RESULTS

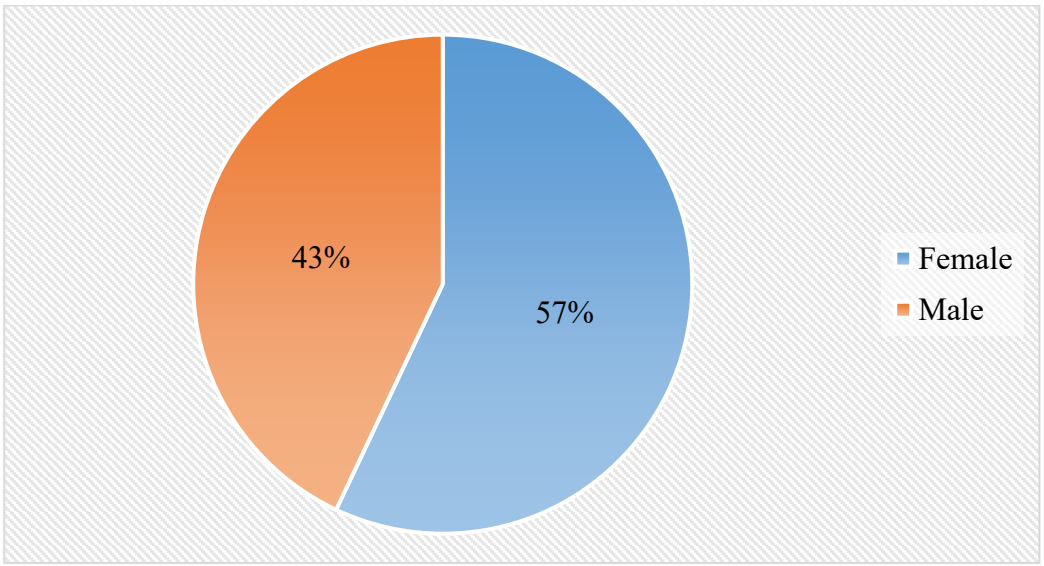

Figure 1: *Gender Distribution among HCV-Screened Patients in Arar City*

The gender distribution shows that out of 384 participants, 219 are female (57 percent) and 165 are male (43 percent). This indicates a slightly higher participation of females compared to males, with females making up more than half of the sample. The cumulative percentage confirms that together they account for the entire group with no missing data.

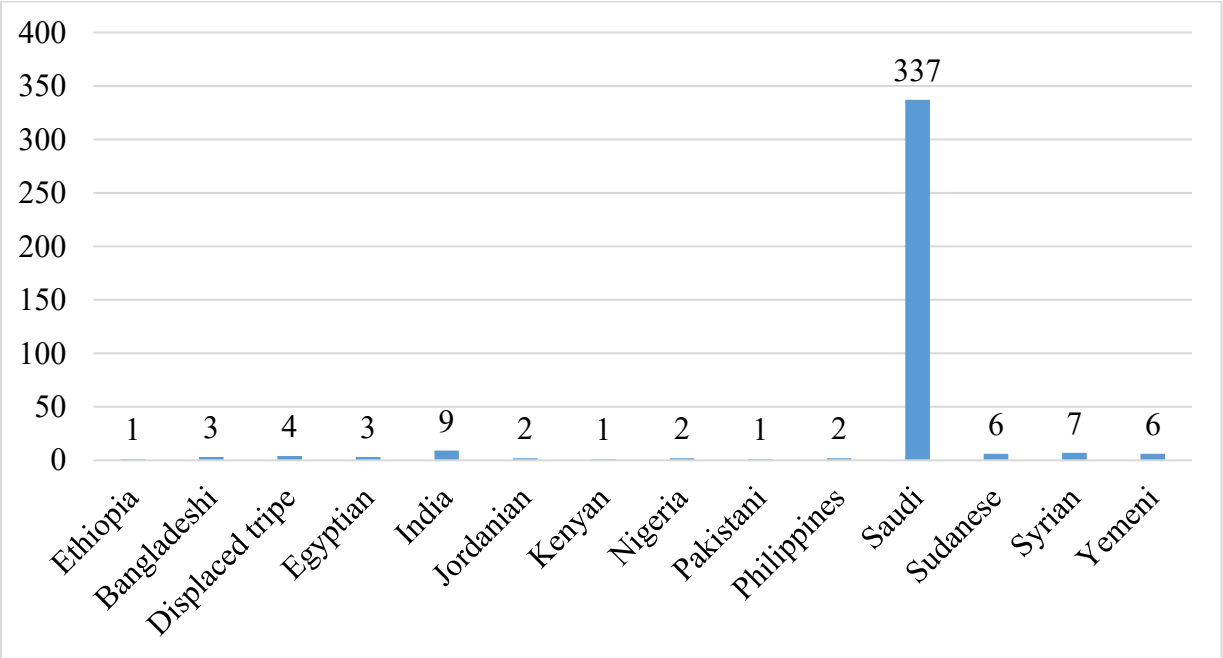

Figure 2: *Nationality Distribution among HCV-Screened Patients in Arar City*

The nationality distribution shows that the vast majority of participants are Saudi, accounting for 337 out of 384 respondents (87.8 percent). The remaining participants represent a mix of nationalities, including Syrian (1.8 percent), Sudanese and Yemeni (1.6 percent each), Indian (2.3 percent), and smaller groups from Bangladesh,

Egypt, the Philippines, Jordan, Nigeria, and others, each contributing less than 1 percent. Only one participant each identified as Ethiopian, Kenyan, or Pakistani. Overall, the data indicates that the sample is overwhelmingly Saudi, with limited representation from other nationalities.

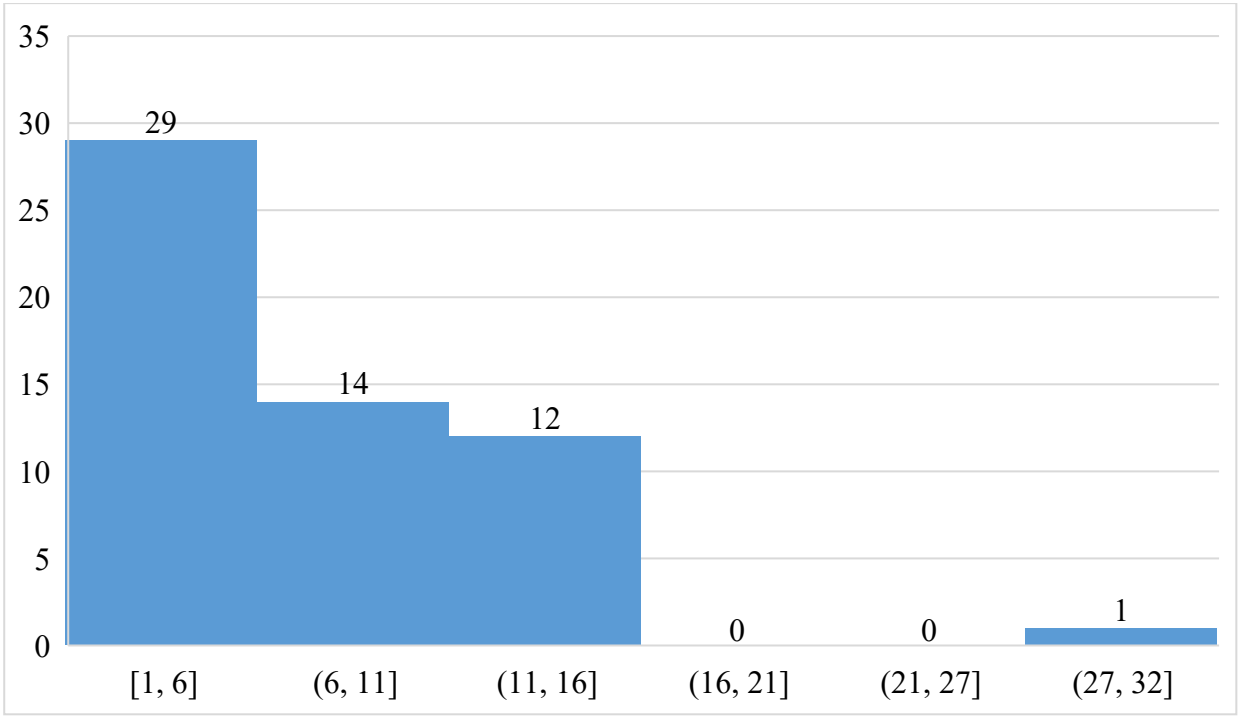

Figure 3: *Age Distribution among HCV-Screened Patients in Arar City*

This age distribution the age distribution of 384 participants, ranging from 11 to 90 years. The majority fall between ages 18 and 40, with the highest concentration at age 32 (7 percent), followed by 35 (4.2 percent), and 24 and 30 (each 3.9 percent). Participants in their twenties and thirties make up a substantial portion of the sample, showing that most respondents are young to middle-aged adults. After age 40, the frequency gradually declines, with only small numbers represented in older age groups, and very few participants above 60. Overall, the distribution is skewed toward younger adults, with limited representation from children, teenagers, and elderly participants.

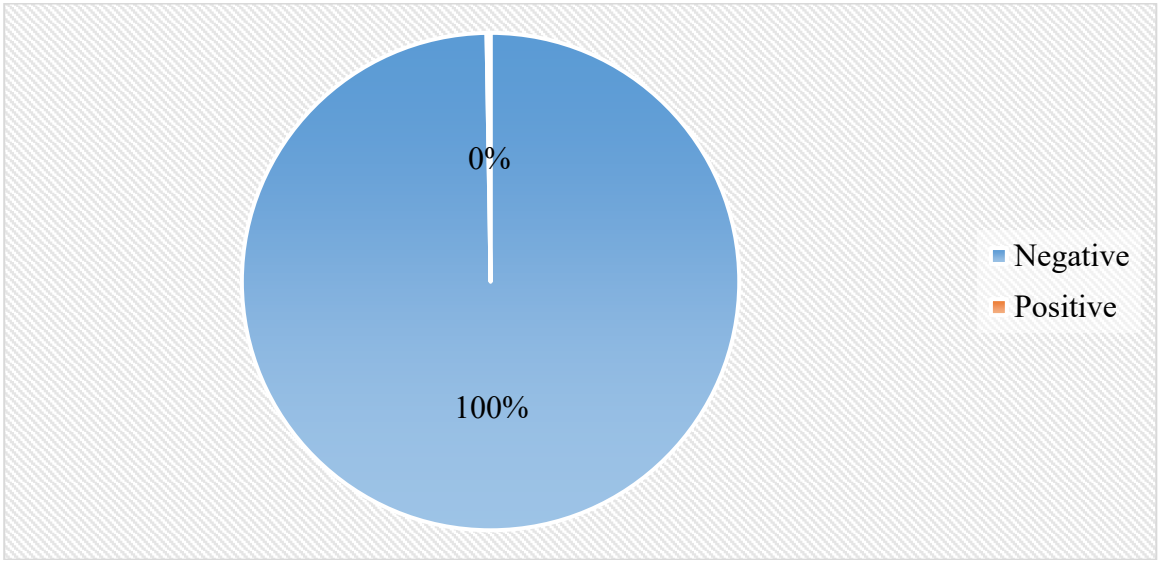

Figure 4: *Test* Result *Distribution among HCV-Screened Patients in Arar City*

The test results show that out of 384 participants, 383 tested negative, representing 99.7 percent of the sample. Only 1 participant tested positive, which accounts for 0.3 percent. This indicates that nearly the entire group had negative results, with a single case of positivity recorded.

DISCUSSION

The findings of this study indicate that the prevalence of Hepatitis C Virus (HCV) infection in Arar City is relatively low, consistent with national epidemiological data from Saudi Arabia that demonstrates a declining trend in HCV incidence in recent years. This finding aligns with previous national studies showing low seroprevalence rates in the overall Saudi population, highlighting the effectiveness of national preventive, screening, and blood safety measures (Al-Raddadi et al., 2018; Almajid et al., 2024). Saudi Arabia's continuous efforts to refine infection control protocols, augment blood donor screening, and expand access to efficacious antiviral medications have significantly diminished HCV transmission within the community.

Despite the typically low frequency, the study indicated a continual rise in new HCV infections in Arar City, particularly among older populations. This finding corresponds with national and regional epidemiological trends indicating that individuals aged 45 and older bear a higher burden of HCV infection. The heightened prevalence in senior populations may be attributed to prior exposure risks, including blood transfusions or surgical procedures performed before the implementation of stringent infection control protocols and routine HCV screening techniques. These findings underscore the importance of age-specific screening protocols, especially for populations that may have been exposed prior to the introduction of modern diagnostic and preventive measures.

The persistent emergence of newly detected cases, even in a low-prevalence setting, highlights the necessity of maintaining continuing and comprehensive screening efforts. Low endemicity does not eliminate the possibility of ongoing transmission or delayed discovery, particularly when diseases remain asymptomatic for extended periods. In such circumstances, the significance of accurate laboratory diagnosis intensifies, since even modest diagnostic errors might have substantial consequences for patients and public health surveillance. The findings highlight that lapses in screening activities may lead to missed opportunities for early detection and timely intervention.

The results demonstrate that Arar City is benefiting from Saudi Arabia's national HCV control initiatives, which include improved screening, advanced laboratory capabilities, and access to direct-acting antiviral therapies. The identification of current cases indicates that localized diagnostic improvement is essential. Tailoring screening approaches to correspond with the demographic and risk attributes of the local population, while concurrently enhancing laboratory capabilities, can markedly enhance early case detection and preventive outcomes. Integrating laboratory data into regional surveillance systems may improve the identification of emerging trends and at-risk populations.

In conclusion, the low prevalence of HCV infection in Arar City reflects successful national public health efforts; nonetheless, the continued identification of cases, particularly among the elderly, highlights the need for sustained diagnostic surveillance. These findings emphasize the importance of maintaining stringent laboratory research and targeted screening programs to support Saudi Arabia's goal of HCV eradication and to prevent missed or delayed diagnosis in low-prevalence settings.

Data were entered and analyzed using appropriate statistical methods. Descriptive statistical methods were employed to summarize the demographic characteristics of the screened population and to determine the prevalence of Hepatitis C Virus (HCV) infection, expressed as frequencies and percentages. The seroprevalence of HCV was calculated as the proportion of individuals with positive screening results to the total number of participants screened.

Stratified analyses were conducted, if appropriate, to examine prevalence patterns across demographic categories and healthcare facilities. Results were presented in tables and figures to improve interpretative clarity. A significance level of $p < 0.05$ was employed for all statistical analyses. This analytical method ensured accurate evaluation and clear representation of HCV prevalence in Arar City.

CONCLUSION

This study demonstrates that the seroprevalence of Hepatitis C Virus infection among individuals screened in Arar City is low, supporting national data indicating a declining HCV burden in Saudi Arabia. The findings highlight the advantageous outcomes of continuous public health activities, including improved infection control protocols, comprehensive blood donor screening, and augmented access to antiviral therapies.

The low frequency of new HCV cases highlights the continued need for routine and targeted screening, particularly among elderly populations who may have been exposed prior to the implementation of modern preventative measures. In low-endemicity settings, it is essential to maintain accurate laboratory diagnostics and continuous surveillance to prevent delayed diagnosis and missed treatment opportunities.

The results support the effectiveness of current national HCV management initiatives and emphasize the need for regional epidemiological monitoring. Improving regional monitoring systems and optimizing screening techniques tailored to local demographic attributes will be crucial for sustaining progress towards the elimination of HCV as a public health issue in Saudi Arabia.

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