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Conceptual framework of factors influencing Hepatitis B preventive awareness and behaviors among Saudi women

Elhadi Miskeen

emiskeen@ub.edu.sa

Department of Obstetrics and Gynecology, College of Medicine, University of Bisha

Shahad Abdullah Mohammed Alshahrani

Department of Obstetrics and Gynecology, College of Medicine, University of Bisha

Abdullah Alhalafi

Family and Community Medicine Department, College of Medicine, University of Bisha

Bayan Mathaf saeed Aloqaybi

Department of Obstetrics and Gynecology, College of Medicine, University of Bisha

Afnan Hezam Alaklabi

Department of Obstetrics and Gynecology, College of Medicine, University of Bisha

Atheer Abdullah Al-Shahrani

Department of Obstetrics and Gynecology, College of Medicine, University of Bisha

Afnan Meshal H Alotaibi

Department of Obstetrics and Gynecology, College of Medicine, University of Bisha

Norah Ali M Albishi

Department of Obstetrics and Gynecology, College of Medicine, University of Bisha

Sara Saeed Alaklabi

Department of Obstetrics and Gynecology, College of Medicine, University of Bisha

Atheer Hameed Alqarni

Department of Obstetrics and Gynecology, College of Medicine, University of Bisha

Suaad Elnour

Department of Obstetrics and Gynecology, College of Medicine, University of Bisha

Mashael Obaid F Alssadi

Department of Obstetrics and Gynecology, College of Medicine, University of Bisha

Azza Elzein

Department of Obstetrics and Gynecology, Dr. Sulaiman Al Habib Medical Group

Mutasim E. Ibrahim

Department of basic sciences, College of Medicine, University of Bisha

Laila Yahya Alhubaishi

Department of Obstetrics and Gynecology, College of Medicine and Health Sciences, Mohammed Bin Rashid University

Research Article

Keywords: Hepatitis B virus, Knowledge, Attitudes, Practices, Women, Prevention, Vaccination, Screening, Saudi Arabia, Bisha, Knowledge-practice gap, Health education

Posted Date: April 23rd, 2026

DOI: https://doi.org/10.21203/rs.3.rs-9108647/v1

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Additional Declarations: No competing interests reported.

Abstract

Introduction: Hepatitis B virus (HBV) infection still poses an important public health issue in Saudi Arabia, despite the availability of effective vaccines and national prevention programs. It is particularly important among women, who play a central role in family health and face a risk of transmitting the infection to their infants during pregnancy and childbirth.
Objectives: This study intends to report the levels of knowledge, attitudes, and practices towards HBV prevalence among non-pregnant Saudi women in Bisha province and thus provide context-specific evidence that can inform a targeted preventive actions framework.

Methods: A community-based cross-sectional study was conducted in Bisha province, Saudi Arabia, from January 2025 to February 2026 among 391 non-pregnant Saudi women aged ≥18 years or older. Data were collected via a structured Arabic questionnaire. We categorized the good knowledge, positive attitude, and good practice as scores ≥75%, ≥80%, and ≥70%, respectively. Statistical analysis was performed using STATA BE, 2025. We employed Chi-square and logistic regression to examine the associations.

Results: The mean±SD scores of knowledge, attitude, and practice were 15.2±3.4, 5.9±1.6, and 6.7±2.1, respectively. Overall, good knowledge was reported by 65.5%, positive attitude by 69.3%, and good preventive practice by 46.8%. There were significant correlations between better KAP and higher education, working as health/education professionals, being richer (income), already vaccinated against HBV, and having taken the respective tests for HBV ($p<0.05$). Only 40.9% were fully vaccinated; ever-screening and HBV health education participants accounted for 45.5% and 31.7%, respectively. In multivariable analysis; good knowledge (adjusted odds ratio 2.12, 95% confidence interval 1.40–3.22), positive attitude (AOR=2.51, 95% CI: 1.64–3.85), vaccination (AOR=3.02, 95% CI: 1.88–4.84) and exposure to previoushealth education session (AOR=1.96, 95% CI: 1.23–3.13) were identified as a predictors of good practice.

Conclusion: Awareness and attitudes toward HBV are generally positive among women in Bisha; however, the preventive practices are substandard. This knowledge–practice gap remains large and is influenced by education, occupation, income, and health service engagement. Tailored interventions integrating education, accessible vaccination, screening, and community-based outreach are needed to improve HBV prevention and align with national elimination goals.

1. INTRODUCTION

HepatitisB virus (HBV) infection is one of the important public health challenges globally. Notably, despite the availability of vaccines and antiviral therapies to treat this useful prototype for prevention, it remains a major contributor to preventable liver-related morbidity and mortality [1–3]. In this context, improving preventive behaviour—particularly vaccination, safe practices, and screening—is central to achieving the World Health Organization (WHO) viral hepatitis elimination targets by 2030, which emphasize reducing new infections and deaths through comprehensive prevention, testing, and treatment strategies [2,4].

The fact that chronic HBV infection is characterized by a prolonged period without symptoms before progression to advanced liver disease suggests the need for primary prevention as well as early detection through routine screening of at-risk groups, including women of reproductive age [3,4,5]. In many societies, women are the primary decision-makers for family health and caregivers; therefore, their knowledge, attitudes, and practices in relation to HBV prevention can strongly influence uptake of vaccination, screening, and safe behaviours within families and communities [1,6,7].

Saudi Arabia has undergone a marked epidemiological transition in HBV burden over the last three decades, after the introduction of universal HBV vaccination into the national childhood immunization programme in 1989 and subsequent coverage scaling up [3,5,8]. This policy, along with premarital screening programmes and improvements in infection control, has led to a decline in HBV prevalence, especially among younger age cohorts [5,8,9]. Nevertheless, HBV remains an important notifiable viral infection in the Kingdom, and incident cases continue to occur, particularly among adults born before the full implementation of the national vaccination programme or with incomplete vaccine coverage [3,5,9,10].

Women in Saudi Arabia constitute a key target group for HBV prevention because of their potential exposure during reproductive events and their influence on family health behaviours [6–8,11]. Vertical transmission has a strong potential for chronic infection and, therefore, premarital and antenatal screening along with counseling for risk groups as well as timely immunoprophylaxis areessential interventions needed to break the cycle of transmission [4,5,11–13]. To better comprehend and prevent their exposure to HBV during their reproductive years, it is important to address the diverse means of such exposure, including medical procedures, cosmetic practices, and household contact with infected family members [1,6,7,11].

Recent Saudi studies indicate that awareness and preventive behaviours regarding HBV among the general public remain suboptimal, with significant gaps in knowledge about transmission routes, complications, and the benefits of vaccination and screening [1,6,7,9,10]. Moderate overall knowledge and attitudes towards viral hepatitis were documented in a national study of Saudi Arabian residents. However, several participants had misconceptions regarding non-blood-borne transmission pathways and were unaware of effective vaccines and curative therapies for certain viral hepatitis types [1]. Additionally, stigma and fear related to hepatitis infection may disincentivize people from getting tested or disclosing their status, thus diminishing the potential impact of existing preventive services [1,9,10].

Studies among health care providers and student groups expected to have higher baseline knowledge have documented only moderate levels of HBV-related knowledge and suboptimal vaccination coverage, suggesting that even among educated populations, preventive behaviour is not uniformly adequate [12,14]. These findings raise concern that lay women in the community, particularly those in smaller cities and rural areas, may have even lower levels of knowledge and engagement in HBV preventive practices [6,7,11].

Women's HBV-related preventive behaviour is influenced by multiple interrelated factors, including socio-demographic characteristics (age, education, income, marital status), health literacy, cultural beliefs, and access to health information and services [6,7,10,11]. In the Al-Baha region of Saudi Arabia, a recent study of adults' awareness of HBV screening before marriage and pregnancy revealed that although many participants had heard of HBV, detailed knowledge of transmission, complications, and the importance of premarital and antenatal screening was limited, and screening uptake was far from universal [7]. Women's awareness and preventive practices in that study were significantly associated with educational level and prior exposure to health education messages, underscoring the critical role of targeted health promotion and counselling [7,10,11].

In addition to socio-demographic and informational determinants, health system and policy-related factors shape preventive behaviour. Saudi Arabia's premarital screening programme—originally designed to reduce hereditary haemoglobinopathies—has been expanded to include certain infectious diseases, including HBV, offering an opportunity to identify and counsel couples before marriage [8,9,15]. However, the effectiveness of such programmes in changing behaviour depends on the quality of counselling, women's autonomy in health decision-making, and the availability and accessibility of follow-up services such as vaccination and specialist referral [3,7,9,15]. Moreover, in areas distant from major urban centres, geographic and logistical barriers may limit women's access to preventive services, despite the existence of national policies and guidelines [3,8,9].

Bisha province, located in the southern region of Saudi Arabia, represents a semi-urban and rural catchment area with a growing population and diverse socio-cultural characteristics [16]. Published data specifically focusing on HBV awareness and preventive behaviour among women in Bisha are scarce, and much of the available evidence on HBV knowledge and practices in Saudi Arabia comes from larger cities or specific professional groups [1,6,7,10–12,14]. This paucity of localized data hampers the ability of regional health authorities and primary care providers to design context-appropriate interventions to improve HBV prevention among women in this area [7,11,16].

With national and global commitments to address the burden of viral hepatitis, and given that the strategic importance of women's health will touch on all relevant risk factors needed to meet these goals, there is a local need for new, community-based studies within under-researched regions in Saudi Arabia [3–5,8,15–21]. We will provide context-specific evidence to support better public health planning, primary care practice, and community outreach interventions in the southern region by investigating factors influencing preventive behaviour towards HBV among women in Bisha province.

The objective of this study is to assess the knowledge, attitudes, and preventive practices related to the hepatitis B virus among non-pregnant Saudi women in Bisha province and to generate context-specific evidence to inform targeted HBV prevention interventions in this population.

2. METHODOLOGY

2.1 Study Setting and Design: This is a cross-sectional analytic study conducted in a community setting. The study involved eligible women from the Bisha province in Saudi Arabia's southern region. It was conducted over 14 months, between January 2025 and February 2026. Bisha is a semi-urban and rural catchment area with diverse socio-cultural characteristics, where previous research on HBV awareness has been limited, and the population is rapidly growing.

2.2 Study Population and Sampling: The target population consisted of non-pregnant Saudi women aged 18 years and older who had been residing in Bisha province for at least six months. Women with cognitive or communication impairments or who declined to participate were excluded.

2.3 Sampling technique (A multistage sampling): This sampling method was developed in 3 stages: (1) Bisha province for this study was divided according to official administrative divisions, into urban (Bisha city) and suburban/rural clusters; (2) within each cluster, households were selected from updated municipal lists using a random start and fixed interval

2.4 The sample size The sample was calculated using the formula:

$$n=Z2\times p(1-p)d2n=d2Z2\times p(1-p)$$

Assuming a prevalence (p) of good HBV knowledge of 50% (to maximize sample size), a 95% confidence level (Z = 1.96), and a margin of error (d) of 5%, the minimum required sample size was 384. To account for potential non-response (10%), 425 women were approached, and 391 completed the survey (response rate: 92%).

2.5 Data Collection Tool and Procedure: We developed a structured, interviewer-administered Arabic questionnaire based on a literature review and validated KAP instruments for HBV. A panel of public health and hepatology experts assessed the questionnaire for content validity, and it was piloted with 30 women (not included in the final sample) to evaluate clarity, reliability (Cronbach's alpha >0.75 for all scales), and cultural acceptability. We made modifications on previous quationnaire [22]

2.6 Instrument: The final survey instrument was structured into six comprehensive sections: (1) sociodemographic details, including age, marital status, education level, occupation, monthly income, place of residence, and family history of hepatitis; (2) knowledge about HBV, comprising 20 items that assessed understanding of transmission routes, symptoms, complications, prevention methods, and vaccination, with a total score ranging from 0 to 20; (3) attitude toward HBV prevention, measured through 8 items on a 5-point Likert scale (from strongly disagree to strongly agree) evaluating perceptions of disease severity, personal susceptibility, and the benefits of preventive actions, yielding a score between 0 and 8; (4) preventive behaviors including 10 items documenting vaccination uptake, history of screening, injection safety (Behaviors related to injecting drug use), receiving blood transfusions in the past and avoiding high-risk activities weresummed for a score ranging from 0 to 10; (5) health-service utilization where Participants response on testing history, HBV vaccination status, participation in health-education activity was evaluated; and (6) sources of information. The data collected included an open-

ended question. Ethical principles were followed, and interviews were carried out by female research data collectors who were trained and had a background in nursing or public health.

2.7 Scoring and Operational Definitions: Good knowledge was defined as a score ≥75% (≥15/20) on the knowledge assessment. From the responses, an overallpositive attitude was defined as 80% or higher score (≥6.4/8), and for evaluation purposes, it was rounded to a publishableevaluating form of ≥6. Correct preventive behaviour indicates being at least ≥7/10 of the prevention scale inpractice. Vaccination statuses were differentiated into (≥3 doses- fully vaccinated), unvaccinated, (1–2 doses-partially vaccinated). Socioeconomic status was determined according to the reported monthly household income: low (10,000 SAR).

2.8 Data Analysis: Data were analysed by STATA version 19 (2025). Besides, descriptive statistics and bivariate analyses were employed to test associations between sociodemographic variables and levels of HBV knowledge, attitude, and practice using chi-square tests. To determine predictors, we used binary logistic regression for the good preventive practice. In the first multivariate model, all variables with a p-value less than 0.20 from the bivariate analysis were included, and a backward stepwise selection was used for the statistically significant predictors ($p < 0.05$) in the final model. RESULTS are reported as AOR (adjusted odds ratios) and 95 % confidence intervals (CIs). However, all statistical tests were two-tailed, and a p-value<0.05 was considered statistically significant.

3. RESULT

The sociodemographic composition of the 391 participating women from Bisha province is detailed in Table 1. The cohort was predominantly of reproductive age, with 201 (51.4%) married and 167 (42.7%) single. A high educational status was noted, with 288 (73.7%) of the women being tertiary-educated. By occupation, 172 (44.0%) were found to be homemakers and 107 (27.4%) students, together constituting the majority of the respondents. Geographically, the sample was biased toward the urban center, with 317 (81.1%) residing in the city of Bisha. Additionally, 72 (18.4%) of the participants reported a family history of hepatitis.

Table 1. Sociodemographic Characteristics of the participants (=391)

Variable	n(%)
Marital Status	
Single	167 (42.7)
Married	201 (51.4)
Divorced	16 (4.1)
Widowed	7 (1.8)
Education Level	
Primary	11 (2.8)
Secondary	1 (0.3)
Post-Secondary	81 (20.7)
University	288 (73.7)
Post-Graduate	9 (2.3)
Occupation	
Housewife	172 (44)
Education Sector	32 (8.2)
Health Professional	24 (6.1)
Banking and business	19 (4.9)
Military	37 (9.5)
Student	107 (27.4)
Residence	
Bisha	317 (81.1)
Bisha suburb	74 (18.9)
Family History of Hepatitis	
Present	72 (18.4)
Not Present	319 (81.6)

Table 2 shows that the overall level of knowledge about hepatitis B among women in Bisha was relatively high, with a mean knowledge score of 15.2 ± 3.4 (out of 20) and a median of 16; nearly two-thirds of participants, 256 women (65.5%), were classified as having good knowledge, whereas only 36 (9.2%) fell into the poor knowledge category. Attitudes toward hepatitis B prevention were also generally favorable, as reflected by a mean attitude score of 5.9 ± 1.6 (out of 8), with 271 women (69.3%) demonstrating

positive attitudes and fewer than 10 (9.7%) reporting negative attitudes. In contrast, preventive practices lagged behind knowledge and attitudes. However, the mean practice score was 6.7 ± 2.1 (out of 10), and fewer than half of the women (183, 46.8%) exhibited good preventive practices. In comparison, 76 (19.4%) reported poor practice levels, indicating a clear knowledge-practice and attitude-practice gap that warrants targeted behavioural and service-level interventions.

Together, these findings indicate a clear knowledge-practice and attitude-practice gap: the large majority of women are knowledgeable regarding hepatitis B and have generally positive attitudes towards its prevention; however, a considerable number still fail to engage in sufficient protective behaviours both in everyday life and when accessing healthcare settings.

This disconnect implies structural, cultural, or service-based barriers. require more than information provision to result in behaviour change, mirroring barriers such as limited access to vaccination, inadequate salutogenic counselling during health encounters, perceived low personal risk (to disease), and competing priorities. This calls for a larger role for interventions that will ensure behavioural support, empowerment, and service delivery to promote action beyond information.

Table 2. Knowledge, attitude and practice scores toward hepatitis B among women in Bisha (n = 391)

Domain	score range	Mean ± SD	Median (IQR)	Min	Max	Category definition*	n (%) good / positive	n (%) fair / neutral	n (%) poor / negative
Knowledge	0–20	15.2 ± 3.4	16 (13–18)	3	20	Good ≥75% (≥15); Fair 50–74% (10–14); Poor <50% (<10)	256 (65.5)	99 (25.3)	36 (9.2)
Attitude	0–8	5.9 ± 1.6	6 (5–7)	1	8	Positive ≥75% (≥6); Neutral 50–74% (4–5); Negative <50% (<4)	271 (69.3)	82 (21.0)	38 (9.7)
Practice	0–10	6.7 ± 2.1	7 (5–8)	0	10	Good ≥75% (≥8); Fair 50–74% (5–7); Poor <50% (<5)	183 (46.8)	132 (33.8)	76 (19.4)

Knowledge of hepatitis B virus (HBV) was dichotomized into “good knowledge” (scoring ≥75% of the total knowledge score) and “poor/moderate knowledge” (scoring <75%). Table 3 summarizes the associations between sociodemographic characteristics and HBV knowledge.

Several sociodemographic and HBV-related variables were significantly associated with knowledge level in univariate analysis.

Higher education level had a strong positive correlation with HBV knowledge ($p < 0.001$). Objective: To find the prevalence of elements of knowledge about smoking in adolescents and to assess their relationship with socioeconomicstatus, health, and substance use. Women with University education represent the largest subgroup (n=288), and 50.3% ofthem were knowledgeable.

Occupation was also significantly linked to knowledge ($p < 0.001$). Health professionals reported the highest rate of good knowledge (75.0%), followed by individuals working in the education sector (62.5%). In contrast, homemakers showed the lowest proportion (37.8%).

There was a positive association of monthly household income with HBV knowledge (10,000 Saudi Riyals (SAR) per month). Good knowledge was observed in 57.0%, while it was 49.7% for the middle-income group(5,000–10,000 SAR), and itwas only 37.6% for the low-income group (<5,000 SAR).

Personal and familial exposure to hepatitis significantly influenced knowledge levels. Women with a family history of hepatitis were more likely to possess good knowledge (58.3%) compared to those without such a history (47.6%) ($p = 0.040$).

Knowledge was also strongly associated with engagement in preventive health behaviors. The knowledge amongvaccinated women (55.1%) was significantly higher than that of unvaccinated or status-unknown women (39.7%) ($p = 0.001$). Likewise, female HBV ever tested subjects had significantly better knowledge (57.3%) compared with those not tested (42.7%, $p < 0.001$).

Knowledge level was associated with age group ($p = 0.077$), marital status ($p = 0.163$), and residence place (urban vs. suburban, $p = 0.055$). While there were some minor differences in numbers between these categories, they did not achieve statistical significance based on chi-square analysis. Higher educational attainment, employment in the health or education sectors, greater household income, family history of hepatitis, prior HBV vaccination, and HBV testing were all positively and significantly associated with good knowledge of hepatitis B among women in Bisha province. In contrast, age, marital status, and residential location did not show significant associations with knowledge level in this sample.

Table 3. Association between sociodemographic characteristics and knowledge level about hepatitis B (n=391)

Variable	n	Good knowledge (≥75%) n (%)	Poor/Moderate knowledge (<75%) n (%)	χ^2	df	p-value
Age group (years)						
18–24	110	45 (40.9)	65 (59.1)	6.84	3	0.077
25–34	142	70 (49.3)	72 (50.7)			
35–44	92	52 (56.5)	40 (43.5)			
≥45	47	20 (42.6)	27 (57.4)			
Marital status						
Single	167	78 (46.7)	89 (53.3)	5.12	3	0.163
Married	201	95 (47.3)	106 (52.7)			
Divorced	16	10 (62.5)	6 (37.5)			
Widowed	7	4 (57.1)	3 (42.9)			
Education level						
Primary	11	2 (18.2)	9 (81.8)	45.23	4	**<0.001**
Secondary	1	0 (0.0)	1 (100.0)			
Post-Secondary	81	35 (43.2)	46 (56.8)			
University	288	145 (50.3)	143 (49.7)			
Post-Graduate	9	8 (88.9)	1 (11.1)			
Occupation						
Housewife	172	65 (37.8)	107 (62.2)	28.91	5	**<0.001**
Education Sector	32	20 (62.5)	12 (37.5)			
Health Professional	24	18 (75.0)	6 (25.0)			
Banking and business	19	10 (52.6)	9 (47.4)			
Military	37	20 (54.1)	17 (45.9)			
Student	107	58 (54.2)	49 (45.8)			
Residence						
Bisha city	317	156 (49.2)	161 (50.8)	3.67	1	0.055
Bisha suburb	74	31 (41.9)	43 (58.1)			
Monthly income						

(SAR)						
<5,000	85	32 (37.6)	53 (62.4)	15.47	2	**<0.001**
5,000–10,000	185	92 (49.7)	93 (50.3)			
>10,000	121	69 (57.0)	52 (43.0)			
Family history of hepatitis						
Present	72	42 (58.3)	30 (41.7)	4.21	1	**0.040**
Not present	319	152 (47.6)	167 (52.4)			
HBV vaccination status						
Vaccinated	245	135 (55.1)	110 (44.9)	10.92	1	**0.001**
Not vaccinated / Unknown	146	58 (39.7)	88 (60.3)			
Ever tested for HBV						
Yes	178	102 (57.3)	76 (42.7)	12.34	1	**<0.001**
No	213	91 (42.7)	122 (57.3)			

*Good knowledge was defined as ≥75% of total knowledge score; poor/moderate knowledge as <75%. SAR = Saudi Riyal. χ^2 = chi-squared statistic; df = degrees of freedom. Statistically significant p-values (p < 0.05) are indicated in **bold**.*

Attitude toward hepatitis B was categorized as “positive” (scoring ≥80% of the total attitude score) or “negative” (scoring <80%). Table 4 presents the associations between sociodemographic characteristics and attitude level among the 391 participants from Bisha province. Education level was significantly associated with attitude toward HBV (p = 0.001). Positive attitude was highest among postgraduates (88.9%) and university-educated participants (66.0%), while only 36.4% of those with primary education expressed a positive attitude. Occupation also showed a significant relationship with attitude (p = 0.007). Health professionals exhibited the most favorable attitude (83.3% positive), followed by individuals in the education sector (75.0%). Housewives reported the lowest proportion of positive attitude (57.0%). Monthly income was positively correlated with attitude (p = 0.009). Among women earning >10,000 SAR, 72.7% held a positive attitude, compared to 64.9% in the middle-income group and 52.9% in the low-income group. A positive attitude was more prevalent among vaccinated women (69.4%) than those unvaccinated or unsure (54.1%) (p = 0.001). Likewise, among women with a history of HBV testing, the proportion with a positive attitude was significantly higher (71.9% vs 56.8%) than those who had never been tested before (p < 0.001). No statistically significant differences in attitude were observed across age groups (p = 0.207), marital status (p = 0.504), residence (urban vs. suburban, p = 0.346), or family history of hepatitis(p = 0.073), although women with a family history showed a numerically higher proportion of positive attitude (72.2%). Higher educational level, employment in the health or education

sectors, greater household income, prior HBV vaccination, and prior HBV testing were all significantly associated with a positive attitude toward hepatitis B among women in Bisha province. In contrast, age, marital status, place of residence, and family history of hepatitis did not significantly influence attitude level in this sample.

Table 4. Association between sociodemographic characteristics and attitude level toward hepatitis B (n=391)

Variable	n	Positive attitude (≥80%) n (%)	Negative attitude (<80%) n (%)	χ^2	df	p-value
Age group (years)						
18–24	110	68 (61.8)	42 (38.2)	4.56	3	0.207
25–34	142	90 (63.4)	52 (36.6)			
35–44	92	65 (70.7)	27 (29.3)			
≥45	47	28 (59.6)	19 (40.4)			
Marital status						
Single	167	108 (64.7)	59 (35.3)	2.34	3	0.504
Married	201	125 (62.2)	76 (37.8)			
Divorced	16	12 (75.0)	4 (25.0)			
Widowed	7	5 (71.4)	2 (28.6)			
Education level						
Primary	11	4 (36.4)	7 (63.6)	18.92	4	**0.001**
Secondary	1	0 (0.0)	1 (100.0)			
Post-Secondary	81	48 (59.3)	33 (40.7)			
University	288	190 (66.0)	98 (34.0)			
Post-Graduate	9	8 (88.9)	1 (11.1)			
Occupation						
Housewife	172	98 (57.0)	74 (43.0)	15.78	5	**0.007**
Education Sector	32	24 (75.0)	8 (25.0)			
Health Professional	24	20 (83.3)	4 (16.7)			
Banking and business	19	12 (63.2)	7 (36.8)			
Military	37	25 (67.6)	12 (32.4)			
Student	107	75 (70.1)	32 (29.9)			
Residence						
Bisha city	317	205 (64.7)	112 (35.3)	0.89	1	0.346
Bisha suburb	74	44 (59.5)	30 (40.5)			
Monthly income (SAR)						

<5,000	85	45 (52.9)	40 (47.1)	9.45	2	**0.009**
5,000–10,000	185	120 (64.9)	65 (35.1)			
>10,000	121	88 (72.7)	33 (27.3)			
Family history of hepatitis						
Present	72	52 (72.2)	20 (27.8)	3.21	1	0.073
Not present	319	197 (61.8)	122 (38.2)			
HBV vaccination status						
Vaccinated	245	170 (69.4)	75 (30.6)	10.58	1	**0.001**
Not vaccinated / Unknown	146	79 (54.1)	67 (45.9)			
Ever tested for HBV						
Yes	178	128 (71.9)	50 (28.1)	12.34	1	**<0.001**
No	213	121 (56.8)	92 (43.2)			

Note:

Positive attitude was defined as ≥80% of total attitude score; negative attitude as <80%. SAR = Saudi Riyal. χ^2 = chi-squared statistic; df = degrees of freedom. Statistically significant p-values ($p < 0.05$) are indicated in **bold**.

Hepatitis B preventive practice differed markedly by sociodemographic and HBV-related characteristics (Table 5). The highest proportion of good practice was observed in women aged 35–44 years (52.2%), followed by (36.4%) among those aged 18–24 years and (42.6%) among those aged ≥45 years, with a significant association between age group and level of practice (p=0.026). On the other hand, the importance of marital status and place of residence (Bisha city vs suburb) had no significant association with preventive practice (p=0.207 and p=0.118, respectively).

There was a strong positive gradient of HBV preventive practice by education level. Only 18.2% of women with primary education reached good practice, rising to 39.5% in the post-secondary educational level, 47.9% among university graduates, and up to 77.8% for women with postgraduate qualifications (p10,000 SAR, p=0.002). The percentage of women reporting good practice was higher among women whose family had a history of hepatitis than in those who did not have that history (58.3% vs. 41.1%, p=0.003).

Preventive practices were most strongly associated with HBV-related service use. Overall, 55.1% of vaccinated women demonstrated good practice, compared with only 26.0% of unvaccinated or undecided women (p<0.001). Likewise, 57.3% women with past testing for HBV had good practice compared to 33.3% of those without testing (p<0.001). These outcomesindicate that tertiary education, employment in

healthcare professionals, high monthly income, family history of hepatitis B, and a previous contact with vaccination and screening services act as determinants leading to adequate HBV preventive behaviours among women living in the context of Bisha province.

Table 5. Association between sociodemographic characteristics and preventive practice toward hepatitis B (n=391)

Variable	n	Good practice (≥70%) n (%)	Poor/Moderate practice (<70%) n (%)	χ^2	df	p-value
Age group (years)						
18–24	110	40 (36.4)	70 (63.6)	9.23	3	0.026
25–34	142	65 (45.8)	77 (54.2)			
35–44	92	48 (52.2)	44 (47.8)			
≥45	47	20 (42.6)	27 (57.4)			
Marital status						
Single	167	72 (43.1)	95 (56.9)	4.56	3	0.207
Married	201	85 (42.3)	116 (57.7)			
Divorced	16	10 (62.5)	6 (37.5)			
Widowed	7	3 (42.9)	4 (57.1)			
Education level						
Primary	11	2 (18.2)	9 (81.8)	32.17	4	**<0.001**
Secondary	1	0 (0.0)	1 (100.0)			
Post-Secondary	81	32 (39.5)	49 (60.5)			
University	288	138 (47.9)	150 (52.1)			
Post-Graduate	9	7 (77.8)	2 (22.2)			
Occupation						
Housewife	172	65 (37.8)	107 (62.2)	24.89	5	**<0.001**
Education Sector	32	18 (56.3)	14 (43.8)			
Health Professional	24	18 (75.0)	6 (25.0)			
Banking and business	19	10 (52.6)	9 (47.4)			
Military	37	20 (54.1)	17 (45.9)			
Student	107	52 (48.6)	55 (51.4)			
Residence						
Bisha city	317	145 (45.7)	172 (54.3)	2.45	1	0.118
Bisha suburb	74	28 (37.8)	46 (62.2)			
Monthly income						

(SAR)						
<5,000	85	28 (32.9)	57 (67.1)	12.78	2	**0.002**
5,000–10,000	185	85 (45.9)	100 (54.1)			
>10,000	121	68 (56.2)	53 (43.8)			
Family history of hepatitis						
Present	72	42 (58.3)	30 (41.7)	8.91	1	**0.003**
Not present	319	131 (41.1)	188 (58.9)			
HBV vaccination status						
Vaccinated	245	135 (55.1)	110 (44.9)	25.64	1	**<0.001**
Not vaccinated / Unknown	146	38 (26.0)	108 (74.0)			
Ever tested for HBV						
Yes	178	102 (57.3)	76 (42.7)	20.13	1	**<0.001**
No	213	71 (33.3)	142 (66.7)			

Note: Good practice was defined as ≥70% of total practice score (including vaccination, screening, and protective behaviors); poor/moderate practice as <70%. SAR = Saudi Riyal. χ^2 = chi-squared statistic; df = degrees of freedom.Statistically significant p-values ($p < 0.05$) are indicated in bold.

Table 6 presents the distribution of self-reported preventive behaviours and health-service use related to hepatitis B among the 391 women in Bisha province. Less than half of the participants (45.5%, n=178) reported ever being screened for HBV, while the majority (54.5%, n=213) had never been screened. Of the patients, 40.9% (n = 160) had completed a vaccination schedule (≥3 doses), while 21.7% (n = 85) had received only one or two doses; more than one-third were not vaccinated for HBV (37 %, n =146). With respect to injection safety, 62.7% (n=245) inquired always about a new syringe before an injection, 25.1% (n=98) did so sometimes, and 12.3% (n=48) never asked for one. Regarding blood transfusion safety, 42.2% (n=165) stated they would ask about blood screening before a transfusion, while 47.8% (n=187) would not; 10.0% (n=39) reported that the question was not applicable because they had no history of transfusion. The majority of women did not (68.3%, n=267) report ever participating in any HBV-related health-education activity; only 31.7% (n= 24) reported previous participation. In general, these results show low levels of HBV screening and incomplete vaccination coverage, as well as limited participation in safety-affirming practices within clinical environments among women in Bisha. Furthermore, exposure to structured HBV health education was low, with fewer than one-third of participants reporting prior involvement in such activities.

Table 6. Preventive behaviours and health-service use related to hepatitis B (n=391)

Preventive Behaviour / Health-Service Use	n	%
Ever screened for hepatitis B		
Yes	178	45.5
No	213	54.5
HBV vaccination status		
Not vaccinated	146	37.3
1–2 doses	85	21.7
≥3 doses (complete schedule)	160	40.9
Ask for new syringe before injection		
Always	245	62.7
Sometimes	98	25.1
Never	48	12.3
Ask about blood screening before transfusion		
Yes	165	42.2
No	187	47.8
Not applicable (no history of transfusion)	39	10.0
Participation in any HBV health-education activity		
Yes	124	31.7
No	267	68.3

Note: Percentages are based on total valid responses (N=391).HBV = Hepatitis B virus.

In multivariable logistic regression (table 7), several individual and HBV-related factors remained independently associated with good preventive practice toward hepatitis B among the participating women. Age was not a significant predictor after adjustment, although women aged 35–44 years showed a non-significant trend toward better practice compared with those aged 18–24 years (adjusted OR 1.65, 95% CI 0.90–3.04, p=0.106).

Educational level showed a strong gradient, with only postgraduate education retaining an independent association with good practice. Compared with women who had only primary education, those with postgraduate qualifications were almost twelve times more likely to report good preventive practice (adjusted OR 11.76, 95% CI 1.85–83.33, p=0.009), whereas post-secondary and university education did not reach statistical significance in the adjusted model. Marital status was not associated with preventive practice after adjustment.

Cognitive and attitudinal domains were important determinants. Women with good HBV knowledge (score ≥75%) had more than twice the odds of good practice compared with those with poor or moderate knowledge (adjusted OR 2.12, 95% CI 1.40–3.22, p<0.001). Similarly, a positive attitude toward HBV prevention (score ≥80%) was associated with 2.5-fold higher odds of good practice (adjusted OR 2.51, 95% CI 1.64–3.85, p<0.001).

Service-related factors showed the strongest associations. Women who had received at least one dose of HBV vaccine were three times more likely to have good preventive practice than unvaccinated women (adjusted OR 3.02, 95% CI 1.88–4.84, p<0.001). Prior exposure to HBV health-education activities was also an independent predictor, with nearly a twofold increase in the odds of good practice (adjusted OR 1.96, 95% CI 1.23–3.13, p=0.005). Although family history of hepatitis was associated with good practice in crude analysis, this association attenuated and lost statistical significance after adjustment (adjusted OR 1.65, 95% CI 0.96–2.84, p=0.071). Overall, these findings indicate that higher education (postgraduate), better HBV knowledge, positive attitudes, vaccination, and prior health-education exposure are key independent drivers of optimal preventive behaviour among women in Bisha province.

Table 7. Logistic regression of factors associated with good preventive practice toward hepatitis B (n=391)

Predictor	Crude OR (95% CI)	p-value	Adjusted OR (95% CI)	p-value
Age group (years)				
18–24 (Ref)	1.00	–	1.00	–
25–34	1.48 (0.88–2.48)	0.138	1.32 (0.75–2.31)	0.332
35–44	**1.91 (1.09–3.35)**	**0.024**	1.65 (0.90–3.04)	0.106
≥45	1.29 (0.64–2.60)	0.480	1.12 (0.53–2.38)	0.763
Education level				
Primary (Ref)	1.00	–	1.00	–
Post-Secondary	2.98 (0.62–14.29)	0.173	2.45 (0.48–12.42)	0.280
University	**4.13 (0.91–18.75)**	**0.066**	**3.55 (0.75–16.81)**	0.110
Post-Graduate	**14.29 (2.38–100.00)**	**0.004**	**11.76 (1.85–83.33)**	**0.009**
Marital status				
Married (Ref)	1.00	–	1.00	–
Single	1.04 (0.69–1.56)	0.860	0.95 (0.61–1.49)	0.820
Divorced/Widowed	1.78 (0.82–3.85)	0.145	1.52 (0.66–3.51)	0.326
HBV knowledge level				
Poor/Moderate (Ref)	1.00	–	1.00	–
Good (≥75%)	**2.45 (1.66–3.61)**	**<0.001**	**2.12 (1.40–3.22)**	**<0.001**
Attitude level				
Negative (Ref)	1.00	–	1.00	–
Positive (≥80%)	**2.89 (1.93–4.35)**	**<0.001**	**2.51 (1.64–3.85)**	**<0.001**
HBV vaccination status				
Not vaccinated (Ref)	1.00	–	1.00	–
Vaccinated (≥1 dose)	**3.55 (2.27–5.56)**	**<0.001**	**3.02 (1.88–4.84)**	**<0.001**
Family history of hepatitis				
No (Ref)	1.00	–	1.00	–
Yes	**2.00 (1.20–3.33)**	**0.008**	1.65 (0.96–2.84)	0.071
Prior HBV health-education exposure				

No (Ref)	1.00	–	1.00	–
Yes	**2.38 (1.54–3.70)**	**<0.001**	**1.96 (1.23–3.13)**	**0.005**

Note: Good practice = preventive practice score ≥70%. Ref = reference category. OR = odds ratio; CI = confidence interval. Adjusted model includes all variables listed in the table. Statistically significant associations ($p < 0.05$) are indicated in bold.

4. DISCUSSION

In this study, we assessed knowledge, attitudes, and preventive practices regarding hepatitis B virus (HBV) among women in Bisha province, Southern Saudi Arabia. The studies show a significant knowledge–practice gap from the data: most participants demonstrated good knowledge (65.5%) and positive attitudes (69.3%) toward HBV prevention, but fewer than half had good preventive practices (46.8%). This difference is also found in previous KAP studies from Saudi Arabia, which followed the same pattern of high awareness and low uptake rates for protective behaviours like vaccination, screening, and safety measures [24-27]. Our results underscore that knowledge alone is insufficient to drive behavioural change; structural, cultural, and health-system barriers likely impede the translation of awareness into action [21].

A significant positive correlation between education level and knowledge on the topic has been previously reported [23,4]. Higher education is significantly associated with good HBV knowledge and positive attitudes in women, likely due to better health literacy and more access to information sources [20]. Nevertheless, even among university-educated women, only 47.9% had good preventive practice behavior, indicating that this level of education enhances cognizance but cannot remove the barriers to behavioral practice. This underscores the importance of interventions that are not solelyinformation-focused, but also address barriers to vaccine access, stigma, and perceived susceptibility [5].

Occupation was another significant predictor, with health professionals showing the highest levels of knowledge, attitude, and practice. This is expected given their formal training and exposure to health information.[26] Conversely, homemakers—who constituted a large proportion of the sample (44.0%)—consistently demonstrated lower KAP scores. This subgroup may be less exposed to workplace health campaigns, have fewer opportunities for screening, and engage in less autonomous health-seeking behaviour; therefore, highlighting them as a priority subgroup for targeted outreach [27].

The socioeconomic status represented by monthly household income was significantly related to all KAP domains. High-income women also had higher knowledge, a positive attitude, and better practices of health-seeking behaviour, which echoes the fact that resource availability influences health engagement [28]. Financial barriers may limit access to vaccination (if not fully covered), transportation to health facilities, or the ability to prioritise preventive care over immediate economic needs [29].

Good knowledge, positive attitude, and adequate practice were more likely among vaccinated individuals and those whohave tested for HBV in the past. This bi-directionality implies that engagement with health

services solidifies bothawareness and motivation, while increased knowledge could lead to increased use of the service [30].

Nevertheless, coverage remains suboptimal: only 40.9% of women were fully vaccinated, and 54.5% had never been screened. These gaps are concerning, given the availability of national vaccination and premarital screening programmes, and indicate deficiencies in programme implementation, counselling, or follow-up.[31]The multivariate analysis identified good knowledge, positive attitude, vaccination receipt, and prior health-education exposure as independent predictors of good preventive practice. This underlines the need for a comprehensive approach to health promotion involving education, advice, and easy access to services. [32] Remarkably, family history of hepatitis was not an independent predictor in the adjusted model, indicating that its effect may be through testing or vaccination rather than practice itself.

The low uptake of HBV-related health education (31.7%) indicates a missed opportunity for behaviour change. Community-based education programmes, culturally relevant and delivered through trusted channels to local communities, could bridge the knowledge–practice gap. Strengthening the integration of HBV prevention into routine maternal and reproductive health services could also improve coverage in women during their reproductive years [33,34, 35].

Based on the study's results, we propose specific education, vaccine screening, and tailored outreach interventions to improve HBV prevention among females in Bisha province (Figure 1). Tailored education through trusted sources, services that are accessible both in terms of distance and cost, community networks, and linkages to the health system can bridge the huge gap between knowledge and practice. This multi-pronged approach will directly contribute to reducing HBV transmission and advancing Saudi Arabia's national viral hepatitis elimination targets.

Limitations

This study has several limitations. It has a cross-sectional design, which precludes causal inference. Self-report practice is possibly subject to social desirability bias. The sample was taken from a single province, which may limit generalisability to other regions of Saudi Arabia. Also, respondents' higher educational attainment than that of the general female population may lead to an overestimation of KAP levels. Validity was enhanced through the use of standardized tools, pilot testing, and trained interviewers. A cross-sectional design limits causal inference, and self-reported practices may be subject to bias. Because the study was limited to one province, it may not be generalizable to other parts of Saudi Arabia.

5. CONCLUSION

However, knowledge and attitudes were generally good towards HBV prevention among the women of Bisha, preventive practices are still sub-optimal. Using regression analyses, KAP is found to be highly correlated with education level, occupation, income, vaccination status, and exposure to health education.

Public health interventions must close existing inequalities in access to targeted education relative to vaccination/screening services to demonstrate efficacy. Incorporating HBV prevention into existing maternal and primary health care services, as well as community awareness-raising campaigns, is likely to improve uptake and contribute to national and global hepatitis elimination efforts.

Abbreviations

AOR	Adjusted Odds Ratio
CI	Confidence Interval
HBV	Hepatitis B Virus
KAP	Knowledge, Attitudes, and Practices
n	Number (of participants)
OR	Odds Ratio
Ref	Reference Category
SAR	Saudi Riyal
SD	Standard Deviation
WHO	World Health Organization

DECLARATION

Ethical Considerations: The Research Ethics Committee of the University of Bisha approved the study protocol (UB-RELOC H-06-BH-087/(1808.24). Informed consent was obtained after the study's purpose, procedures, risks, benefits, and confidentiality measures were explained. Data were anonymized and stored in password-protected files accessible only to the research team.

Consent to Publish declaration: not applicable.

Availability of data and materials: The data used in this study are available on request

Competing Interests: None declared

Funding: This study was not funded.

Authors' contributions: EM conceived and designed the study, supervised data collection and analysis, and led manuscript drafting and revision. SA, AA, BM, AH, AS, AAO, NA, SA, AHQ, SE, MO, and MEI contributed to data collection, data entry, and preliminary analysis, and reviewed the manuscript for important intellectual content. LYH and MEI provided methodological and statistical guidance,

contributed to interpretation of findings, and critically revised the manuscript. All authors read and approved the final version of the manuscript and agree to be accountable for all aspects of the work.

AI declaration: Artificial intelligence (AI)–assisted tool (Grammarly, 2025, Grammarly Inc. San Francisco, California, USA.) were used to support language editing, reference formatting, and refinement of the structure of this manuscript. The GPT-5.4 was used to design the graphical abstarct. The authors independently verified all clinical data, interpretations, and references, and take full responsibility for the content and conclusions presented.

Acknowledgments: The authors are thankful to the Deanship of Graduate Studies and Scientific Research at University of Bisha for supporting this work through the Fast-Track Research Support Program.

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Figures

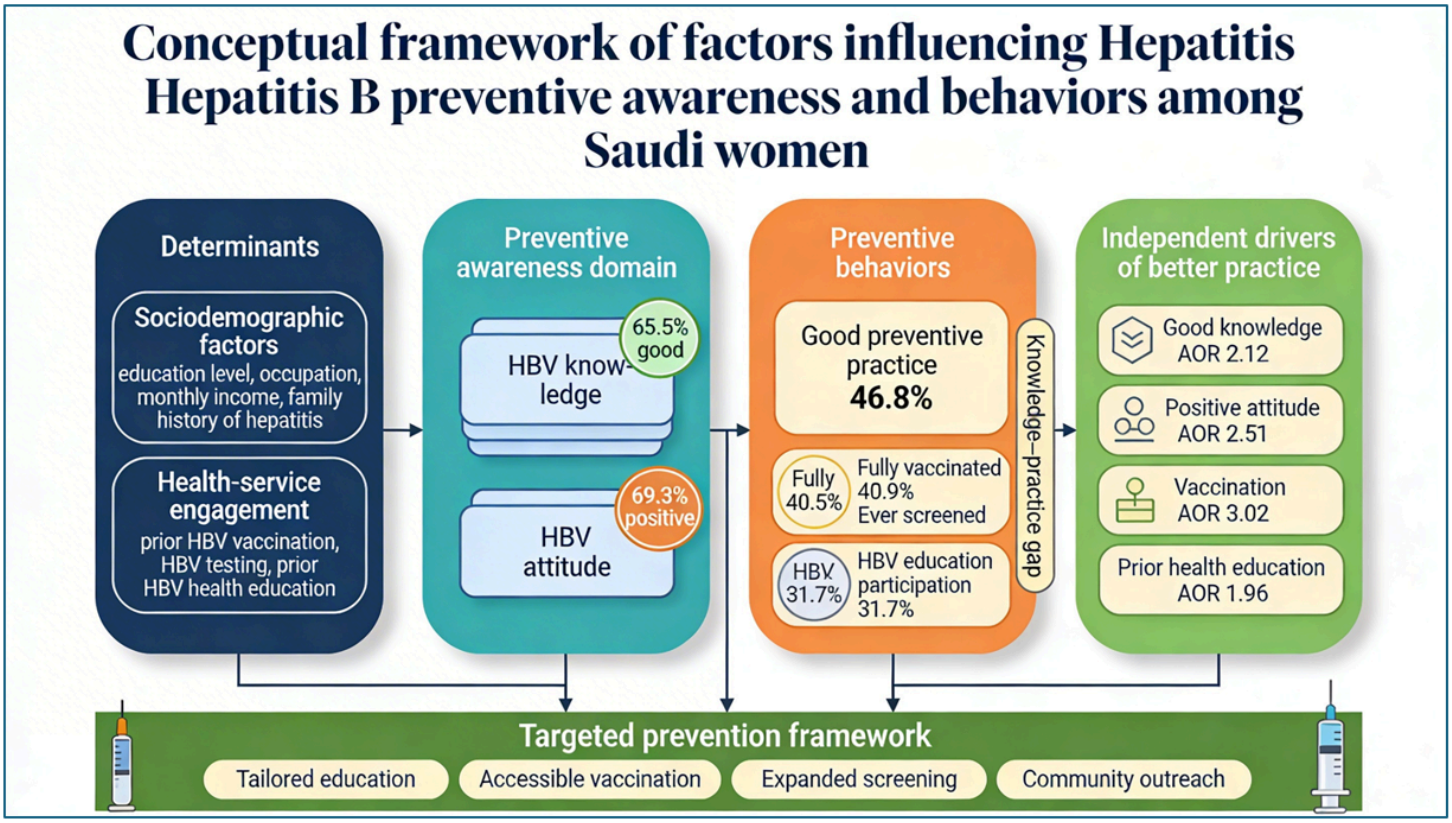


Figure 1

Tailored intervention integrate education, vaccination, screening, and outreach to address the identified knowledge-practice gap and improve HBV prevention among women in Bisha

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- Quationnaire.docx
- Graphicalabstract.png