EAHRC
EAST AFRICAN HEALTH RESEARCH COMMISSION
Research for Health and Prosperity

ORIGINAL ARTICLE

Predictors of Hepatitis B Virus Vaccine Uptake Among Women of Reproductive Age, in South Sudan: Conceptualising Health Belief Model

Ezbon WApary[b], Akway M. Cham[b], Amanya Jacob[a], Kon Alier[a], Oromo F. Seriano[a], Kenneth Sube[a]

[a]School of Medicine, University of Juba, Juba, South Sudan; [b]School of Public Health, University of Juba, Juba, South Sudan; [c]Republic of South Sudan, Ministry of Health, Directorate of Policy, Planning, Budgeting & Research.

Correspondence to Ezbon WApary (w.apary@gmail.com)

ABSTRACT

Background: Hepatitis B virus (HBV) remains a public health problem in South Sudan. Vaccination is currently the most effective means of protection against HBV infection. However, there is limited evidence regarding the uptake of the vaccine among women of reproductive age (WRA) in South Sudan. This study aimed to examine the predictors of HBV vaccine uptake among WRA in Juba City, South Sudan.

Methods: This study adopted a mixed methods cross-sectional design with quantitative and qualitative components among WRA accessing health services at seven health facilities in Juba, South Sudan from May to July 2024. A validated semi-structured questionnaire was used to collect data related to HBV vaccine uptake, women characteristics, health behaviour factors from the 1808 randomly selected women. The study used Stata version 15 and ATLAS.ti version 7 for analyses. Chi squared tests and regression model were performed to determine associations and likelihood, respectively.

Results: Among the 1,808 women, 37.7% received HBV vaccine as observed uptake and 65.8% as model's predicted uptake. Of those who received the vaccine, 56.9% had full dose. The demographic factors associated with uptake of HBV vaccine were; residential area (p<.001), level of education (p<.001), employment status (p<.001). Similarly, health behaviours associated with uptake of vaccine were; blood transfusion (p<.001), and surgical operation (p<.001). The women who attended formal education were two times more likely to receive HBV vaccine compared to those who did not (OR 1.988, 95% CI: 1.508 - 2.621). Employed women of reproductive age were two times more likely to receive HBV vaccine than the unemployed (OR 1.676, 95 CI: 1.339 - 2.097). Women who had close contact with a case of hepatitis B were two times more likely to receive the vaccine than those who had not had close contact with a case of hepatitis B (OR 1.509, 95% CI:1.13 - 2.016). The study identified these themes: benefits of HBV vaccine uptake (prevention of HBV and its complications, prevention of vertical transmission and social benefit (herd immunity)). Furthermore, the results of major theme of barriers to HBV vaccine uptake included lack of vaccine information, limited access to vaccination, fear of adverse reactions, and financial constraints.

Conclusion: HBV vaccine uptake among women of reproductive age in Juba city remains suboptimal. Uptake was associated with residential area, level of education, employment status, blood transfusion history, and surgical operation history. The study recommends strengthening tailored health promotion interventions, addressing identified barriers, expanding antenatal HBV screening, and providing continuous in-service training for health workers.

BACKGROUND

Hepatitis B virus (HBV) is a partially double-stranded, enveloped virus with a circular DNA genome. It belongs to the family Hepadnaviridae. A first infection with HBV is considered an acute infection, whereas an infection lasting more than six months is defined as chronic infection. Transmission of HBV from mother to child during birth is known as vertical transmission. Horizontal transmission refers to transmission from one host to another (e.g., through sexual contact with an infected person, or blood transfusion).

Globally, 296 million people were living with chronic HBV infection, representing a prevalence of 3.8% in the general population. An estimated 1.5 million new infections and 820,000 deaths occur annually, with liver cirrhosis and hepatocellular carcinoma (HCC) accounting for most of these deaths. HBV affects approximately 6 million children younger than five years, with a prevalence of 0.9%. At the end of 2019, 30.4 million people living with HBV were aware of their hepatitis B status. Worldwide, coverage of the third dose of HBV vaccine was 85%, while timely birth- dose coverage was estimated at 43%. Additionally, 6.6 million people diagnosed with hepatitis B were receiving treatment.[1,2]

The burden of HBV infection is highest in the WHO Western Pacific Region and the WHO African Region. HBV persistently infects 82.3 million people in Africans, with 25% mortality rate or at least 200,000 deaths annually. In the Western Pacific Region, 116 million people are living with HBV infection, representing a prevalence of 5.9% in the general population. Approximately 360,000 children younger than five years are chronically infected by HBV, representing a prevalence of 0.3%. Whereas 60 million people are infected in the Eastern Mediterranean Region, 18 million are in the South-East Asia Region, 14 million in the European Region and 5 million in the Region of the Americas.[2]

Of People living with HBV infection in the WHO African Region, only 2% (1,800,000) are aware of their status and 0.1% (110,000) have access to HBV treatment. Access to HBV treatment is highest in the Western Pacific Region at 5%.[2]

Within Sub-Saharan Africa (SSA), HBV infection is endemic, and the HBV- related disease burden is high. The lifetime risk of HBV infection exceeds 60%, and more than 8% of the population remain chronic HBV carriers who are at risk of progressive liver disease and HCC.[3] Hepatocellular carcinoma is a highly aggressive cancer with limited treatment options, particularly in resource-limited setting. SSA has one of the highest HBV-related liver cancer rates in the world, with HBV-related liver cancer being the most common cancer among males and third most common cancer among females.[1,4]

HBV is most commonly transmitted vertically, that is, from mother to child during childbirth. It is also transmitted horizontally through contact with blood or other body fluids during sexual intercourse with an infected partner, unsafe injections or exposure to sharp instruments.[5]

Diagnosis of HBV requires laboratory confirmation since it is not possible to clinically differentiate hepatitis B from other forms of viral hepatitis. To ensure blood safety and prevent accidental transmission through transfusion, all blood donors are screened for HBV. A safe and effective HBV vaccine protects against HBV infection, with protection ranging from 98% to 100%, thereby preventing chronic disease, liver cirrhosis and liver cancer.[5]

South Sudan is not an exception among African countries. The magnitude of HBV endemicity is high and has become a major public health problem. A country with a hepatitis B prevalence exceeding 8% is considered highly endemic.[6] For instance, the prevalence of chronic HBV infection among South Sudanese general population is estimated at 22.4%.[7] Seropositivity of hepatitis B among blood donors was reported as 8.9% at Maridi County Hospital[8]; 18% at Juba Teaching Hospital Blood Bank[9] and 8.2% at the National Blood Bank in 2018.[8] The prevalence of HBV infection among pregnant women attending Juba Teaching Hospital stands at 11%[10] and 6.3%.[11] Uptake of the hepatitis B vaccine among health workers at Juba Teaching Hospital stands at 44.2%.[12]

In this regard, South Sudan has been categorized as a highly endemic country, with an estimated HBV prevalence exceeding 8%.[13] This high prevalence necessitated the development of the National Strategic Plan on Viral Hepatitis in South Sudan 2020-2024, which envisages, *"halting hepatitis transmission in South Sudan while ensuring that everyone living with viral hepatitis has access to safe, affordable and effective prevention, care and treatment services."*

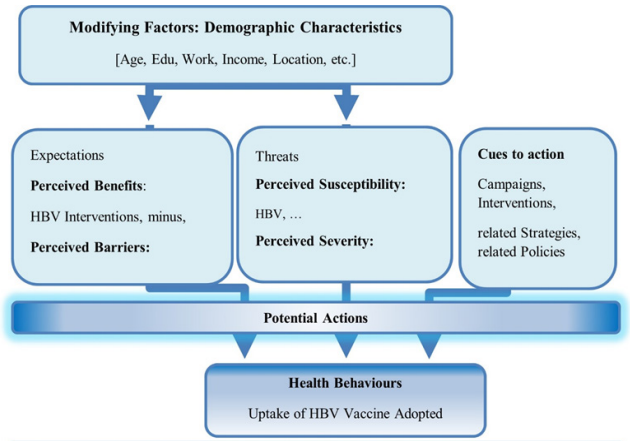
Although a safe and highly effective HBV vaccine protects against HBV infection,[14] there is little evidence regarding the predictors of vaccine uptake among women of reproductive age in South Sudan, as well as the perceived benefits and barriers influencing uptake. Thus, this study aims to examine the predictors of hepatitis B virus (HBV) vaccine uptake among women of reproductive age. The findings will facilitate the generation of evidence- base recommendations to policy makers to strengthen the country's health system.

This study was guided by the Health Belief Model (HBM). The HBM was developed by social scientists in the early 1950s at the United States Public Health Service to explain the failure of individual to adopt disease preventive strategies. Its later applications included understanding patients' responses to symptoms and compliance with therapeutic interventions.

The central concept of the HBM is that a person's belief in their susceptibility to and the severity of an illness or disease, together with their belief in the effectiveness of a recommended health behaviour or strategies, influences the likelihood of adopting that behaviour.

The HBM constitutes four key constructs: perceived severity, perceived susceptibility, perceived benefits, and perceived barriers. These either collectively or individually can be applied to articulate the health behaviour. Contemporary versions of the HBM expanded to incorporate more three constructs: cues to action, modifying factors, and self-efficacy (Figure 1).

FIGURE 1: Conceptual Framework: Health Belief Model



The HBM is based on the understanding that an individual is more likely to undertake a health-related action, such as receiving the HBV vaccine, if they believe that an adverse health condition is preventable, and that

vaccination is an effective preventive strategy. The model also supports understanding adherence to HBV treatment and other preventive behaviours.

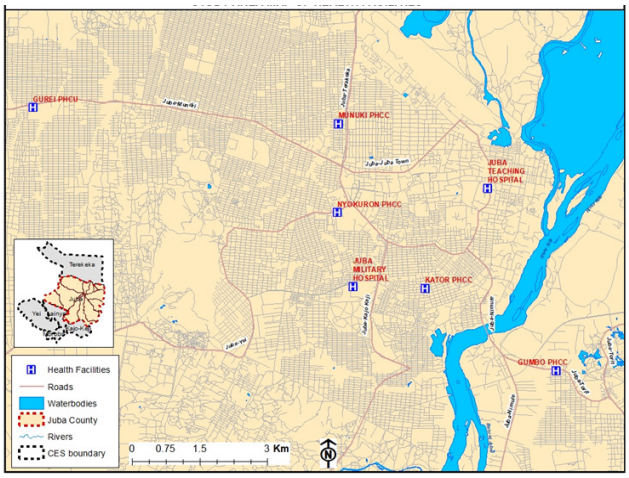
METHODS

Study Areas

South Sudan consists of ten states, namely; Central Equatoria, Eastern Equatoria, Jonglei, Lakes, Northern Bahr El Ghazal, Unity, Upper Nile, Warrap, Western Bahr El Ghazal, and Western Equatoria, as well as three administrative areas: Abyei, Pibor, and Ruweng. Juba is both the capital city of South Sudan and the capital of Central Equatoria State.

The study was conducted in Juba, a city with a heterogeneous population. Juba has a population of 372,413 people, with a growth rate of 4.23%. Juba City comprises three block councils (Figure 2): Juba, Kator and Munuki.[15] Of the 28 health facilities in Juba city, the following were selected as the study sites: Juba Teaching Hospital, Juba Military Hospital, Nyakuron PHCC, Kator PHCC and Munuki PHCC. In addition, Gumbo PHCC and Gurei PHCC were considered due to high concentration of observed maternal services users. These health facilities were collectively referred to as the selected health facilities.

FIGURE 2: Map Showing Health Facilities in Juba City, South Sudan



Research Design

This study adapted mixed-methods cross-sectional design with quantitative and qualitative components to examine the uptake of HBV vaccine among women of reproductive age in Juba City, South Sudan. A semi structured questionnaire was used to collect the data.

Study Population

The study population consisted of women of reproductive age (18 - 49 years) who attended healthcare services, including antenatal and reproductive health services, at the selected health facilities in Juba City between May and July 2024.

Sample Size and Sampling Techniques

The sample size was determined from the Cochran's formula [16–18] to estimate a statistically representative sample size.

The proportion of HBV vaccine uptake in Juba city was assumed to be at 50% (0.5) since it was unknown among women of reproductive age of Juba City South Sudan. The margin of error was set at 5% (0.05), the design effect was 4, and the non-response rate was 15%. Thus, the final sample size was 1808 women of reproductive age.

The sampling procedures used were purposive and systematic sampling. Health facilities within the Juba city council blocks were selected purposively based on utilisation rates. The study population was then stratified by health facility, namely; Juba Teaching Hospital, Juba Military Hospital, Nyakuron PHCC, Kator PHCC, Munuki PHCC, Gumbo PHCC, and Gurei PHCC. Afterwards, the sampling frame, comprising lists of women of reproductive age attending services at each health facility was obtained from the respective facility administration. Proportionate- to- size allocation technique was applied to determine the number of participants to be selected from each facility.

The sample size was proportionally allocated to each health facility based on their sample frame, using Formula 1: Proportionate- to- size frame

$$n_i = \mathbf{n} * (N_i / \mathbf{N})$$

Where:

n ≡ total sample size (1808)

n_i ≡ required sample size in each health facility

N_i ≡ number of the women attending each health facility

N ≡ total number of women attending all selected health facilities.

Participants were selected from the seven health facilities using a computer-based systematic random sampling technique until the sample size saturation level was reached. This procedure was considered appropriate since the study targeted a relatively homogeneous population, namely, women of childbearing age (Table 1).

Data Collection Methods and Procedure, Inclusion & Exclusion Criteria

A trained and experienced research team comprising midwives collected primary data using a validated semi-structured questionnaire.[19] The questionnaire collected information on HBV vaccine uptake, participants' characteristics, health behaviour factors, and the perceived benefits and barriers to vaccine uptake among the 1,808 randomly selected women. Data collection commenced after ethical approval had been obtained and informed consent had been secured from participants.

The inclusion criteria were women aged 18 to 49 years who accessed healthcare services, including antenatal care at selected health facilities in Juba city. The exclusion criteria were women outside the age range of 18 to 49 years and those who declined to participate in the study.

TABLE 1: Proportionate to Sample Frame Allocation of Research Participants to the Health Facilities

Health Facility	N_i = Number of WRA in Each HF	n_i= required sample size in each HFs: $n_i = (n*N_i)/N$	Systematic random sampling (every n^th)
Gumbo PHCC	734	212	3
Gurei PHCC	1063	305	3
JMH	1237	355	3
JTH	1457	418	3
Kator PHCC	398	114	3
Munuki PHCC	545	156	3
Nyakuron PHCC	864	248	3
Total	6298	1808	

Data Management and Analysis Techniques

EpiData version 4.7 (EpiData Association, Denmark) was used to design the questionnaire. The completed dataset was subsequently exported to Stata version 15 for analysis. The data quality assurance procedures included checking for completeness, data entry, validating, coding, cleaning and transformation before analysis.

Because the outcome variables were HBV vaccine uptake, analyses included cross-tabulations and logistic regression. Chi-square tests, phi coefficients (effect size), Fisher exact tests, Spearman correlation coefficients, odds ratios, 95% confidence intervals, and *p*-values were computed as appropriate. These analyses were conducted to determine the relationship between predictor variables and HBV vaccine uptake. Predictor variables were treated as independent variables, while HBV vaccine uptake was treated as the dependent variable.

Qualitative data were extracted from the semi structured questionnaires, cleaned and prepared for analysis. The data were then imported into ATLAS.ti version 7, where they were coded and analysed to identify patterns and themes related to the perceived benefits and barriers to HBV vaccine uptake among women of reproductive age in Juba City. The HBM guided the qualitative analysis.

Ethical Consideration

Ethical clearance was obtained from South Sudan Research and Ethical Review Board (Reference No: MOH/RERB/P/S.31/05/024). The clearance was subsequently forwarded to the Director General of the Central Equatoria State Ministry of Health to permit data collection at the respective health facilities. At each health facility, written informed consent was obtained from all participants. Confidentiality, anonymity, and voluntary participation were assured throughout the study.

RESULTS

The Sociodemographic Characteristics of Women of Reproductive Age

Table 2 shows descriptive analysis of the sociodemographic characteristics of women of reproductive age who participated in the study. A total of 1808 women participated, yielding a response rate of 99.9%. The mean age was 27.21 years (SD± 6.29), with an age range of 18 to 49 years (Table 3). Participants were recruited from seven health facilities, with majority (23.1% n=418) from Juba Teaching Hospital (JTH).

Most participants (47.8%; n=864; 95% CI: 45.3-49.9) were aged 25 to 34 years. The majority (56%; n=1,013); 95% CI: 53.9-58.5) resided outside the Juba City Council blocks. The mean parity was 2.88 (95% CI: 2.78 - 2.98) (Table 3).

The vast majority of participants originated from the Greater Equatoria Region. Christians constituted 87.3% of the participants. Most participants (78.2%) had attained formal education, more than half (54.5%) were unemployed. Unmarried women accounted for 10.5% of the study population. Among married women, 61.7% were in monogamous unions. Women with parity of less or equal to 3 constituted 64.7% of the participants (Table 2).

The Level of Hepatitis B Vaccine Uptake Among Women of Reproductive Age

To assess the level of HBV vaccine uptake among women of reproductive age in Juba city, South Sudan, a total of 1808 participants were interviewed. Of these, 37.7% had received the HBV vaccine. Among vaccinated women, 56.9 % had received three doses, 23.6% had received two doses, and 19.5% had received one dose (Table 4, Figure 3).

The level of HBV vaccine uptake varied across health facilities. Uptake was highest at Kator Primary Health Care Centre (PHCC) (50.9%), followed by Juba Teaching Hospital (41.9%), Nyakuron PHCC (40.3%), Juba Military Referral Hospital (36.2%), Gumbo PHCC (35.4%), Gurei PHCC (32.4%) and Munuki PHCC (30.1%). Thus, Kator PHCC recorded the highest level of HBV vaccine uptake among the selected healthcare facilities (Table 4).

Among women aged ≥ 45 years, more than half (53.6%) had received the HBV vaccine. Vaccine uptake was 37.6% among Christians and 40.1% among Muslims, whereas none of the traditional believers reported receiving the vaccine. Women who attended formal education were more likely to have received the HBV vaccine than those with no formal education (Table 4).

TABLE 2: Sociodemographic Characteristics of Women of Reproductive Age in Juba, South Sudan (N = 1,808)

Variable	n	% (95% CI)
Age group		
18 - 24 years	672	37.2 (35-39.5)
25 - 34 years	864	47.8 (45.3-49.9)
35 - 44 years	244	13.5 (11.8-15.1)
≥ 45 years	28	1.5 (1-2.2)
Residential area in Juba		
Juba Block Council	131	7.2 (6.1-8.4)
Kator Block Council	358	19.8 (17.9-21.6)
Munuki Block Council	531	29.4 (27.3-31.6)
Others	788	43.6 (41.4-45.9)
Religion		
Christianity	1579	87.3 (85.8-88.9)
Islam	222	12.3 (10.7-13.8)
Traditional Beliefs	7	0.4 (0.1-0.7)
Formal education		
No	395	21.8 (19.9-23.8)
Yes	1413	78.2 (76.2-80.1)
Main occupation		
Housewife	1343	74.3 (72.2-76.3)
Others	465	25.7 (23.7-27.8)
Employment status		
Unemployed	986	54.5 (52.3-56.9)
Employed	334	18.5 (16.8-20.2)
Self-employed	488	27 (24.9-28.8)
Marital status		
Unmarried	189	10.5 (9.1-11.9)
Married	1415	78.3 (76.4-80.4)
Separated/widow	204	11.3 (9.7-12.7)
Type of marriage		
Monogamy	999	61.7 (59.3-63.9)
Polygamy	620	38.3 (36.1-40.7)
Parity		
≤ 3	1169	64.7 (62.4-66.9)
> 3	639	35.3 (33.1-37.6)
Monthly family income (SSP)		
≤ SSP150,000	7	0.4 (0.1-0.7)
≤ SSP300,000	149	8.2 (7-9.5)
≤ SSP450,000	511	28.3 (26.3-30.5)
≤ SSP600,000	355	19.6 (17.8-21.4)
≥ SSP600,001	786	43.5 (41.2-45.8)
Monthly family income (USD)		
≥ USD50	147	8.1 (6.9-9.3)
≥ USD100	519	28.7 (26.7-30.8)
≥ USD150	345	19.1 (17.1-20.7)
≥ USD200	456	25.2 (23.2-27.2)
≤ USD201	341	18.9 (17.1-20.6)

Among the regions of South Sudan, women originating from Greater Equatoria had an HBV uptake of 39.9%. Administrative units with vaccine uptake exceeding the overall uptake rate of 37.7% included Western Bahr El Ghazal, Warrap, and Western Equatoria. Women residing in rural areas had an uptake of 33.4%, compared with 41.1% among those residing in urban areas (Table 4).

The study participants who smoked shishia (tobacco), 46.3% had received the HBV vaccine. Vaccine uptake was 50.3% among women who consumed alcohol, 50.5% among those who reported close contact with a person infected with HBV, 53.8% among those who had undergone surgical procedure, and 53.8% among those who had received a blood transfusion (Table 4).

TABLE 3: Descriptive Statistics of Age, Parity, Monthly Family Income, and Hepatitis B Vaccine Doses (N = 1,808)

Variable	Mean	SD	95% CI
Age in years	27.21	6.29	(2.78-2.99)
Parity	2.88	2.25	(2.78-2.98)
Monthly family income USD	148.7	93.09	(144.45-153.17)
Monthly family income SSP	579930.86	363053.04	(563370.98-597376)
HBV vaccine dose	2.37	0.79	(2.31-2.43)

The demographic factors significantly associated with HPV vaccine uptake were residential area in Juba [X^2 (3)=20.321,*p*<.001,phi=0.106], state of origin [X^2 (12)=21.943,*p*=.038,phi=0.110], level of education [X^2 (3)=67.605,p<.001,phi=0.193], employment status [X^2(2)=54.748,*p*<.001,phi=0.174], marital status [X^2 (2)=12.181,*p*=.002,phi=0.082], and monthly family income [X^2 (4)=12.925,*p*=.012,phi=0.085].

Health behaviours factors significantly associated with HBV vaccine uptake included health facility attended [X^2 (6)=20.616, *p* <.001,phi=0.107], blood transfusion [X^2 (1)=28.202, *p* <.001,phi=0.125], surgical operation [X^2(1) =27.867,p<.001,phi=0.077], smoking shishia (tobacco) [X^2 (1)=10.791,*p*<.001,phi=0.077], drinking alcohol [X^2(1)=2 7.590,*p*<.001,phi=0.124]. Therefore, the null hypothesis was rejected. On the other hand, age group, religion, parity, scarification, and tribal marks were not significantly associated with HBV vaccine uptake (Table 4).

Variables that were statistically significant at the bivariate level were considered in the multivariable logistic regression model to determine the likelihood of association. Preliminary analysis indicated no evidence of problematic multicollinearity (overall tolerance = 0.973). Assessment of standardised residual values emphasised that there were outliers which were kept in the dataset. Thus, the model was statistically significant, [X^2 (31,N=1808)=179.436, *p* <.001], showing that the model could differentiate women who had received the HBV vaccine from those who had not. Consequently, the model clarified between 9.4% (Cox & Snell) and 12.9% (Nagelkerke) of the variance in HBV vaccine uptake and correctly predicted 65.8% uptake of HBV vaccine among women of reproductive age (Table 5).

As shown in Table 6, residential area, formal education, employment status, monthly family income, close contact with an HBV case, smoking shishia (tobacco) and alcohol consumption made statistically significant contribution to the model.

Analysis of Odd Ratios (OR) for factors that influenced uptake of HBV vaccine is illustrated in Table 7. Women who had attained formal education were approximately

TABLE 4: Factors Related to Level of HBV Vaccine Uptake Among Women of Reproductive Age in Juba, South Sudan

Sociodemographic factors	Uptake of HBV vaccine No	Yes	Total	Chi square	df	*p value*	Phi value
Access to health facility							
JTH	243 (58.1)	175 (41.9)	418	20.616	6	.002	0.107
JMRH	226 (63.8)	128 (36.2)	354				
Gurei PHCC	207 (67.6)	99 (32.4)	306				
Nyakuron PHCC	148 (59.7)	100 (40.3)	248				
Gumbo PHCC	137 (64.6)	75 (35.4)	212				
Munuki PHCC	109 (69.9)	47 (30.1)	156				
Kator PHCC	56 (49.1)	58 (50.9)	114				
Age group							
18 - 24 years	425 (63.2)	247 (36.8)	672	3.282	3	.350	0.043
25 - 34 years	536 (62)	328 (38)	864				
35 - 44 years	152 (62.3)	92 (37.7)	244				
≥ 45 years	13 (46.4)	15 (53.6)	28				
Residential area in Juba							
Juba	90 (68.7)	41 31.3)	131	20.321	3	<.001	0.106
Kator	218 (60.9)	140 (39.1)	358				
Munuki	293 (55.2)	238 (44.8)	531				
Others	525 (66.6)	263 (33.4)	788				
Region of origin							
GER	845 (60.1)	561 (39.9)	1406	13.512	2	.001	0.086
GBR	105 (67.3)	51 (32.7)	156				
GUR	176 (71.5)	70 (28.5)	246				
State of origin							
Central Equatoria	607 (59.9)	406 (40.1)	1013	21.943	12	.038	0.11
Eastern Equatoria	127 (62.3)	77 (37.7)	204				
Western Equatoria	111 (58.7)	78 (41.3)	189				
Jonglei	93 (68.4)	43 (31.6)	136				
Lakes	64 (71.9)	25 (28.1)	89				
Unity	40 (71.4)	16 (28.6)	56				
Upper Nile	27 (79.4)	7 (20.6)	34				
Northern Bahr El Ghazal	14 (66.7)	7 (33.3)	21				
Warrap	11 (55)	9 (45)	20				
Western Bahr El Ghazal	9 (50)	9 (50)	18				
Pibor	12 (80)	3 (20)	15				
Abyei	7 (87.5)	1 (12.5)	8				
Ruweng	4 (80)	1 (20)	5				
Religion							
Christianity	986 (62.4)	593 (37.6)	1579	4.789	2	.091	0.051
Islam	133 (59.9)	89 (40.1)	222				
Traditional Beliefs	7 (100)	0 (0)	7				
Education level							
No formal education	299 (75.7)	96 (24.3)	395	67.605a	3	<.001	0.193
Primary education	411 (66.2)	210 (33.8)	621				
Secondary education	259 (54.1)	220 (45.9)	479				
Tertiary Education	157 (50.2)	156 (49.8)	313				
Main occupation							
Housewife	882 (65.7)	461 (34.3)	1343	25.621	1	<.001	0.119
Others	244 (52.5)	221 (47.5)	465				
Employment status							
Unemployed	690 (70)	296 (30)	986	54.821	2	<.001	0.174
Employed	179 (53.6)	155 (46.4)	334				
Self-employed	257 (52.7)	231 47.3)	488				

Continue

TABLE 4: Continued

Sociodemographic factors	Uptake of HBV vaccine No	Yes	Total	Chi square	df	*p value*	Phi value
Marital status							
Unmarried	108 (57.1)	81 (42.9)	189	2.370	1	.124	-0.036
Married	1018 (62.9)	601 (37.1)	1619				
Marital status							
Unmarried	108 (57.1)	81 (42.9)	189	12.181	2	.002	0.082
Married	910 (64.3)	505 (35.7)	1415				
Separated/widow	108 (52.9)	96 (47.1)	204				
Type of marriage							
Monogamy	641 (64.2)	358 (35.8)	999	1.848	1	.174	0.034
Polygamy	377 (60.8)	243 (39.2)	620				
Parity							
≤ 3	739 (63.2)	430 36.8)	1169	1.238	1	.266	0.026
> 3	387 60.6)	252 39.4)	639				
Monthly family income							
≤ SSP150,000	3 (42.9)	4 (57.1)	7	12.925	4	.012	0.085
≤ SSP300,000	85 (57)	64 (43)	149				
≤ SSP450,000	347 (67.9)	164 (32.1)	511				
≤ SSP600,000	225 (63.4)	130 (36.6)	355				
≥ SSP600,001	466 (59.3)	320 (40.7)	786				
Monthly family income							
≥ USD50	81 (55.1)	66 (44.9)	147	15.735	4	.003	0.093
≥ USD100	353 (68)	166 (32)	519				
≥ USD150	220 (63.8)	125 36.2)	345				
≥ USD200	279 (61.2)	177 (38.8)	456				
≤ USD201	193 (56.6)	148 (43.4)	341				
Scarification/tribal marks							
No	920 (62.2)	560 (37.8)	1480	.047	1	.828	-0.005
Yes	206 (62.8)	122 (37.2)	328				
Exposed to dental procedure							
No	894 (62.6)	534 (37.4)	1428	.308	1	.579	0.013
Yes	232 (61.1)	148 (38.9)	380				
Ever blood transfused							
No	1022 (64.6)	561 (35.4)	1583	28.202	1	<.001	0.125
Yes	104 (46.2)	121 (53.8)	225				
Surgically operated							
No	1024 (64.5)	563 (35.5)	1587	27.867	1	<.001	
Yes	102 (46.2)	119 (53.8)	221				
Close contact with a case of hepatitis B							
No	990 (64.6)	543 (35.4)	1533	22.705	1	<.001	0.112
Yes	136 (49.5)	139 (50.5)	275				
Ever used tobacco							
No	972 (63.9)	549 (36.1)	1521	10.791	1	.001	0.077
Yes	154 (53.7)	133 (46.3)	287				
Ever taken alcohol							
No	960 65.1)	514 34.9)	1474	27.590	1	<.001	0.124
Yes	166 (49.7)	168 (50.3)	334				
Total	1126 (62.3)	682 (37.7)	1808				

TABLE 5: Summary of Statistical Model: Multivariable Logistic Regression Analyses

Chi-square	df	Sig.
179.977	32	<0.001
Cox & Snell R Square	Nagelkerke R Square	
0.094	0.128	

TABLE 6: Classification Table Predicting HBV Vaccine Uptake Among WRA

Observed		Predicted Uptake of HBV vaccine		Percentage Correct
		No	Yes	
Uptake of HBV vaccine	No	967	159	85.9
	Yes	459	223	32.7
Overall Percentage				65.8

TABLE 7: Predictors of Hepatitis B Vaccine Uptake Among Women of Reproductive Age in Juba, South Sudan

Predictor	B	S.E.	Wald	df	*p value*	OR (95% CI LL, UL)
Access to health facility						
JTH*						
JMRH	-0.052	0.166	0.096	1	.756	0.95 (0.686, 1.315)
Gurei PHCC	-0.324	0.173	3.506	1	.061	0.723 (0.515, 1.015)
Nyakuron PHCC	-0.1	0.177	0.319	1	.572	0.905 (0.64, 1.280)
Gumbo PHCC	-0.161	0.194	0.696	1	.404	0.851 (0.582, 1.243)
Munuki PHCC	-0.398	0.22	3.276	1	.070	0.672 (0.437, 1.034)
Kator PHCC	-0.009	0.263	0.001	1	.974	0.991 (0.592, 1.660)
Residential area in Juba						
Juba*						
Kator	0.48	0.235	4.158	1	.041	1.616 (1.019, 2.563)
Munuki	0.655	0.222	8.705	1	.003	1.925 (1.246, 2.974)
Others	0.339	0.225	2.28	1	.131	1.404 (0.904, 2.180)
Region of origin						
GER*						
GBR	-1.653	1.095	2.279	1	.131	0.191 (0.022, 1.637)
GUR	-0.489	1.166	0.176	1	.675	0.613 (0.062, 6.022)
State of origin						
Central Equatoria						
Eastern Equatoria	-0.207	0.172	1.442	1	.230	0.813 (0.5811.140)
Western Equatoria	-0.019	0.172	0.012	1	.913	0.981 (0.700, 1.376)
Jonglei	0.285	1.183	0.058	1	.809	1.33 (0.131, 13.513)
Lakes	1.375	1.121	1.503	1	.220	3.953 (0.439, 35.594)
Unity	0.226	1.203	0.035	1	.851	1.253 (0.119, 13.251)
Upper Nile	-0.282	1.251	0.051	1	.822	0.754 (0.065, 8.763)
Northern Bahr El Ghazal	1.732	1.198	2.09	1	.148	5.654 (0.540, 59.197)
Warrap	2.196	1.188	3.416	1	.065	8.986 (0.876, 92.221)
Western Bahr El Ghazal	2.183	1.202	3.296	1	.069	8.873 (0.840, 93.676)
Pibor	0.216	1.343	0.026	1	.872	1.241 (0.089, 17.243)

Continue

TABLE 7: Continued

Predictor	B	S.E.	Wald	df	*p value*	OR (95% CI LL, UL)
Main occupation						
Housewife*						
Others	0.132	0.14	0.895	1	.344	1.141 (0.868, 1.501)
Employment status						
Unemployed*						
Employed	0.516	0.114	20.351	1	<.001	1.676 (1.339, 2.097)
Marital status						
Unmarried*						
Married	-0.027	0.183	0.021	1	.885	0.974 (0.680, 1.395)
Separated/widow	0.18	0.223	0.65	1	.420	1.197 (0.773, 1.854)
Monthly family income USD	0.001	0.001	4.817	1	.028	1.001 (1.000, 1.003)
Surgically operated						
No*						
Yes	0.525	0.158	10.988	1	.001	1.69 (1.239, 2.304)
Contact with case of hepatitis B						
No*						
Yes	0.411	0.148	7.757	1	.005	1.509 (1.13, 2.016)
Ever used tobacco						
No*						
Yes	-0.09	0.171	0.281	1	.596	0.913 (0.654, 1.277)
Ever taken alcohol						
No*						
Yes	0.492	0.154	10.226	1	.001	1.635 (1.210, 2.21)
Constant	-1.991	0.327	37.181	1	0	0.137

*Reference category

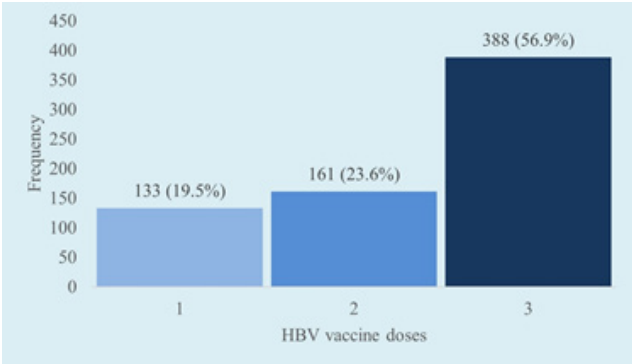
two times more likely to receive the HBV vaccine as those with no formal education (OR 1.988, 95% CI:v 1.508 - 2.621). Employed women were two times more likely to receive the HBV vaccine than unemployed women (OR 1.676, 95 CI: 1.339 - 2.097). Women who reported close contact with a person infected with HBV were two times more likely to receive the vaccine than those without such contact (OR 1.509, 95% CI: 1.13 - 2.016). Similarly, women who consumed alcohol were more likely to have received the HBV vaccine than those who did not consume alcohol (OR 1.635, 95% CI: 1.210 - 2.21). It was observed that women who smoked shisha were less likely to have received the vaccine (OR 0.913, 95% CI: 0.654 - 1.277).

Benefits of and Barriers to HBV Vaccine Uptake Among the Women

Analytical Themes

This qualitative component explored the following question: What are the benefits of and the barriers to HBV vaccine uptake among women of reproductive age in Juba City, South Sudan? The findings are presented according to themes derived from the Health Belief Model. The themes relating to the benefits of HBV vaccine uptake included prevention of HBV infection and its complications, prevention of vertical transmission and social benefit (herd immunity). Furthermore, barriers to HBV vaccine uptake were organised into lack of vaccine information, limited access to vaccination, fear of adverse reactions, and financial constraints.

FIGURE 3: The Level of Hepatitis B Vaccine Uptake Among Women of Reproductive Age in Juba, South Sudan



The Benefits of HBV Vaccine Uptake

Prevention of HBV Infection and Its Complications

Respondents identified prevention of HBV infection as the primary benefit of vaccination. Participants perceived the vaccine providing protection against infection and reducing the risk of contracting the virus.

"I heard of the information that the vaccine protects against HBV infection, which is why I went and got the vaccine." (P09)

"It protects one from contacting the virus. It prevents or fights against the virus." (P13)

Participants also recognised the role of vaccination in preventing serious health consequences associated with HBV infection, liver disease and liver cancer.

"The Hepatitis B Virus vaccine series protect me and my baby against further infections of the disease." (P12)

"It protects the immunity of a body; it reduces deaths related to the disease." (P23)

"It reduces the risk of liver disease and liver cancer." (P11)

"To prevent the spread of the infections to others and further complications." (P31)

Prevention of Vertical Transmission

Another perceived benefit was the prevention of mother-to-child transmission of HBV. Participants believed that vaccination protects both mothers and their unborn children from infection.

"The benefit of getting hepatitis B vaccine is to people, myself and my foetus from getting HBV infections." (P21)
"The vaccine prevents the mother and unborn baby from getting HBV and helps the baby to fight against HBV in case the baby gets in contact with an infected person." (P03).

Social Benefits and Herd Immunity

Participant also perceived broader social and family benefits from vaccination against HBV. They believed that once the level of herd immunity in the population increases, the spread of HBV also reduces within the community.

"The benefits of getting hepatitis B vaccine are important to the family members." (P19)

"The Benefit is for my family and me because I lost my husband to hepatitis B. I would love all to get vaccinated." (P32)

"Importance of getting hepatitis B vaccine because it will prevent all family at home." (P02)

"It helps prevent infection of the virus; it stops the spread of virus." (P25)

"Protects the mother and unborn child from getting hepatitis; prevents the spread of hepatitis B virus in the community." (P22)

The Barriers to HBV Vaccine Uptake

Lack of Vaccine Information

Lack of awareness and inadequate information about HBV and the vaccine emerged as a major barrier to vaccine uptake. Participants reported limited knowledge regarding availability, importance, and benefits of vaccination.

"It is due to no information the vaccine and I cannot get something that I do not have knowledge about." (P15)

"I never thought of vaccination because I am good." (P29)

"There is no information about the vaccine here. Reach to communities about this vaccination." (P33)

"There is no proper information about the vaccine at community. The information did not reach to village of Wangleri." (P27)
"I am not interested in getting the vaccine because I have no signs of the disease." (P01)

Fear of Adverse Reactions

Concerns regarding vaccine safety and adverse effects were also reported as barriers to vaccine uptake.

"I don't like it because it brings pain to the whole body." (P35)

"I fear adverse reactions and more information is needed." (P26)

Limited Access to Vaccination

Participants expressed frustration and concern over the scarcity of HBV vaccines, describing it as a major barrier to protecting their health. Many felt vulnerable when public facilities lacked vaccination services, forcing delays or costly alternatives.

(P36) lamented, "no HBV vaccine at Juba Teaching Hospital," while another was redirected to a private facility for vaccination, *"I have referred to a private health facility for the vaccine."* (P05)

Financial Barriers

The cost of vaccination emerged as an important barrier. Participants indicated that the vaccine expensive and often unaffordable.

"Because I am negative, and I cannot afford the hepatitis B virus vaccine." (P10)

"The vaccine is expensive about, SSP 10,000. My husband earns little money." (P16)

"I am not able to buy the vaccine because it is expensive." (P17)

"I did not go for check up, I do have no signs of the sickness, and I do not have money." (P34)

"For hepatitis B vaccine is so expensive that I do have neither time nor money to go and test." (P04)

Other Barriers

Co-infection and existing illness were also identified as barriers to vaccine uptake. One participant explained:

"I am positive for hepatitis B, positive to human immunodeficiency virus (HIV), and have liver problems. That is why there is no need for the vaccine." (P24)

DISCUSSION

The primary aim of this study was to examine the predictors of HBV vaccine uptake among women of reproductive age in Juba City, South Sudan. The discussion is based on the findings of this study and in compares them with findings from related studies conducted in both developing and developed countries.

The Level of Hepatitis B Vaccine Uptake Among Women of Reproductive Age

Whereas a safe and highly effective HBV vaccine protects against HBV infection,[14] there was no evidence regarding the uptake of the vaccine in South Sudan among women of reproductive age. This study therefore contributes important evidence to fill this knowledge gap. Nonetheless, the observed uptake of HBV vaccine remains substantially lower than the global three-dose HBV vaccination coverage of 85%.[20]

However, the uptake observed in this study was relatively higher than that reported in some previous studies. For example, 33% of Chinese women of reproductive age accessed HBV vaccine at a university obstetric unit in Hong Kong.[21] Similarly, among Nigerian women of reproductive age, only 13.2% had received the vaccine, while approximately 5% had completed the full vaccination schedule.[22]

This variation in vaccine uptake across settings may be attributed to socio-demographic characteristics and health-related behaviours. In the present study, HBV vaccine uptake was higher among older women with formal education, and women who reported previous exposure to HBV risk factors such as blood transfusion, surgical procedures, and contact with individuals infected with HBV.

This study identified several demographic factors that were significantly associated with uptake of HBV vaccine uptake, including level of education, employment status, residential area, state of origin, marital status and monthly family income. These findings are consistent with a study conducted in Korea, which reported that household income and education level were significantly associated with completion of the HBV vaccination series.[23]

Furthermore, this research demonstrated that health-related factors significantly associated with vaccine uptake included health facility attended, blood transfusion, history of surgical operation, smoking shisha and alcohol consumption. On the other hand, age group, religion, parity, dental procedures, scarification, or tribal marks were not statistically associated with uptake of HBV vaccine.

Multivariable logistic regression analysis showed that participants who had attained formal education were two times more likely to receive HBV vaccine as those with no formal education. Similarly, employed women of reproductive age were more likely to be vaccinated than unemployed women. Women who reported close contact with a case of hepatitis B were also more likely to receive the vaccine. Likewise, alcohol consumers were more likely to report HBV vaccine uptake than those who did not drink alcohol. Women who smoke shisha had lower odds of vaccine uptake.

The positive association between education and vaccine uptake may be explained by increased access to health information and a better understanding of the benefits of vaccination. Similarly, employment and higher household income may facilitate access to vaccination services by reducing financial barriers. Women who had previous exposure to HBV-related risk factors may have perceived themselves to be at greater risk of infection and therefore been more motivated to seek vaccination.

Benefits of and the Barriers to HBV Vaccine Uptake Among Women

This qualitative component explored the perceived benefits of and barriers to HBV vaccine uptake among women of reproductive age. Understanding these perspectives is important for informing policies and interventions aimed at improving vaccine uptake. Participants identified prevention of HBV and its complications, prevention of vertical transmission and broader social protection through herd immunity as the major benefits of HBV vaccination.

Although there is limited qualitative literature specifically examining HBV vaccine uptake among women of reproductive age, the findings of this study are consistent with studies on vaccine uptake elsewhere. For instance, previous studies have shown that individuals are motivated to uptake vaccines because of the desire to protect themselves, their families and their communities against vaccine preventable diseases. Observing others receiving vaccines has also been reported as a facilitator of vaccine uptake.[24]

Structural facilitators, including health promotion activates and affordable or free vaccination service have also been shown to encourage vaccine uptake. Furthermore, comprehensive health education through health facilities and communities improves awareness of vaccine preventable diseases and demystified misconceptions regarding vaccine safety and effectiveness. Comprehensive information about vaccines, including their benefits and potential side effects, may further improve vaccine acceptance.[24]

The consistency in the study's findings may be attributed to the general health outcome of vaccination, that is, protection of individuals and communities against vaccine preventable diseases. The findings also support the Health Belief Model, which proposes that individuals are more likely to adopt preventive health behaviours when they perceive themselves to be at risk of an illness or disease and believe that the recommended intervention is effective in reducing that risk.[25]

Furthermore, this study revealed several barriers to HBV vaccine uptake, including lack of vaccine information, limited access to vaccination services, fear of adverse reactions, and financial constraints. Similar barriers have been reported in studies examining uptake of other adult vaccines. Lack of vaccine information remains one of the most frequently cited barrier, with many individuals being unaware of the existence of a vaccine, benefits, safety or eligibility requirements.[26,27]

Limited access to vaccination services also presents an important challenge. Unlike structured childhood vaccination programs, adult vaccination is often less routine and depends heavily on healthcare providers and service availability. Weak health infrastructure, economic inequality and geographic barriers may further limit access, particularly among indigenous and rural populations.[26,28,29]

Financial barriers were also identified as a major concern. Participants reported that vaccine costs and competing financial priorities limited their ability to obtain vaccination. In addition, tight work schedule hindered participation in vaccination exercises, for example, going to work early and closing late. As a result, vaccinees have to plan ahead and consider taking time off work to follow the recommended vaccination schedule. [28,24,29]

Study Limitations

This study has several limitations. First, the cross-sectional design provided only a snapshot of HBV vaccine uptake among women of reproductive age and therefore could

not establish causal relationships between predictors and vaccine uptake. Secondary, the findings are generalizable primarily to women who accessed public health facilities in Juba city and may not fully represent women who do not utilise public health facilities or those residing in other parts of South Sudan.

CONCLUSION

The question focused on predictors of HBV vaccine uptake among women of reproductive age in Juba city, South Sudan. Although 37.7% of women reported receiving at least one dose of the vaccine, only 56.9% of the vaccinated women had completed the three-dose vaccination series. Key predictors of HBV vaccine uptake included level of education, employment status, contact with case of HBV, blood transfusion history, history of surgical operation, and alcohol consumption. The study recommends strengthening tailored health promotion interventions, expanding access to HBV vaccination services, enhancing antenatal HBV screening, and providing continuous in-service training for health workers.

REFERENCES

1. WHO. Hepatitis B. 2019. Accessed June 16, 2022. https://www.who.int/news-room/fact-sheets/detail/hepatitis-b
2. WHO. Global Progress Report on HIV, Viral Hepatitis and Sexually Transmitted Infections, 2021: Accountability for the Global Health Sector Strategies 2016–2021: Actions for Impact: Web Annex 1: Key Data at a Glance. World Health Organization; 2021. Accessed October 12, 2022. https://apps.who.int/iris/handle/10665/342808
3. Spearman CW, Dusheiko G, Jonas E, et al. Hepatocellular carcinoma: measures to improve the outlook in sub-Saharan Africa. Lancet Gastroenterol Hepatol. 2022;7(11):1036-1048. doi:10.1016/S2468-1253(22)00041-3
4. Spearman CW, Dusheiko G, Jonas E, et al. Hepatocellular carcinoma: measures to improve the outlook in sub-Saharan Africa. Lancet Gastroenterol Hepatol. Published online July 7, 2022:S2468-1253(22)00041-3. doi:10.1016/S2468-1253(22)00041-3
5. WHO. Hepatitis B. 2022. Accessed February 27, 2024. https://www.who.int/news-room/fact-sheets/detail/hepatitis-b
6. WHO. Hepatitis B. World Health Organization; 2002. Accessed December 8, 2022. https://apps.who.int/iris/handle/10665/67746
7. Schweitzer A, Horn J, Mikolajczyk RT, Krause G, Ott JJ. Estimations of worldwide prevalence of chronic hepatitis B virus infection: a systematic review of data published between 1965 and 2013. Lancet Lond Engl. 2015;386(10003):10003.doi:10.1016/S0140-6736(15)61412-X
8. MoH R. Treatment and Care Guidelines for Viral Hepatitis in South Sudan. MoH RSS. 2020. Accessed September 17, 2022. https://moh.gov.ss/about-us.php
9. Sube KLL, Seriano OF, Gore RP, et al. The prevalence of HIV among blood donors at Juba Teaching Hospital Blood Bank, South Sudan. 2014. Accessed December 8, 2022. http://www.southsudanmedicaljournal.com/archive/november-2014/the-prevalence-of-hiv-among-blood-donors-at-juba-teaching-hospital-blood-bank-south-sudan.html
10. Kirbak A, Ng'ang'a Z, Omolo J, Idris H, Usman A, Mbabazi WB. Sero-prevalence for Hepatitis B virus among pregnant women attending antenatal clinic in Juba Teaching Hospital, Republic of South Sudan. Pan Afr Med J. 2013;26. doi:10.11604/pamj.2017.26.72.11410
11. Cham AM, Clever SS, Celestino RJ, Thom RCCEC. The Burden of Hepatitis B among Pregnant Women Attending Antenatal Care (ANC) Services in Juba Teaching Hospital (JTH) - Juba South Sudan. IJRDO -J Health Sci Nurs. 2017;2(12):12. doi:10.53555/hsn.v2i12.1732
12. Alege JB, Gulom G, Ochom A, Kaku VE. Assessing Level of Knowledge and Uptake of Hepatitis B Vaccination among Health Care Workers at Juba Teaching Hospital, Juba City, South Sudan. Adv Prev Med. 2020;2020:1-11. doi:10.1155/2020/8888409
13. MoH R. The National Strategic Plan on Viral Hepatitis in South Sudan 2020-2024. MoH RSS. 2020. Accessed September 17, 2022. https://moh.gov.ss/about-us.php
14. WHO. Hepatitis B. 2022. Accessed August 31, 2022. https://www.who.int/news-room/fact-sheets/detail/hepatitis-b
15. NBS. The Republic of South Sudan. 2011. Accessed March 18, 2022. https://www.ssnbss.org/
16. Charan J, Biswas T. How to Calculate Sample Size for Different Study Designs in Medical Research? Indian J Psychol Med. 2013;35(2):121-126. doi:10.4103/0253-7176.116232
17. Ionas I. Quantitative Research by Example version: 1.0.0 {}. Published online 2019.
18. Asaye Z, Aferu T, Asefa A, et al. Prevalence of Hepatitis B Virus Among Pregnant Women on Antenatal Care Follow-Up at Mizan-Tepi University Teaching Hospital and Mizan Health Center, Southwest Ethiopia. Int J Gen Med. 2021;14:195-200. doi:10.2147/IJGM.S292070
19. WApary E, Cham AM, Seriano OF. Validity of semi-structured questionnaire for prevalence and risk factors of hepatitis B virus infections among women of reproductive age. South Sudan Med J. 2024;17(4):4.
20. Pattyn J, G H, A V, P VD. Hepatitis B Vaccines. J Infect Dis. 2021;224(12 Suppl 2). doi:10.1093/infdis/jiaa668
21. Chan OK, Suen SSH, Lao TTH, Leung VKT, Yeung SW, Leung TY. Determinants of hepatitis B vaccine uptake among pregnant Chinese women in Hong Kong. Int J Gynecol Obstet. 2009;106(3):232-235. doi:10.1016/j.ijgo.2009.03.043
22. Eleje GU, Akaba GO, Mbachu II, et al. Pregnant women's hepatitis B vaccination coverage in Nigeria: a national pilot cross-sectional study. Ther Adv Vaccines Immunother. 2021;9:25151355211032595. doi:10.1177/25151355211032595
23. Park B, Choi KS, Lee HY, Jun JK, Park EC. Socioeconomic inequalities in completion of hepatitis B vaccine series among Korean women: Results from a nationwide interview survey. Vaccine. 2012;30(40):5844-5848.

doi:10.1016/j.vaccine.2012.07.022

24. Afrifa-Anane GF, Larbi RT, Addo B, et al. Facilitators and barriers to COVID-19 vaccine uptake among women in two regions of Ghana: A qualitative study. PLOS ONE. 2022;17(8):e0272876. doi:10.1371/journal.pone.0272876

25. Babitsch B, Gohl D, von Lengerke T. Re-revisiting Andersen's Behavioral Model of Health Services Use: a systematic review of studies from 1998-2011. Psycho-Soc Med. 2012;9:Doc11. doi:10.3205/psm000089

26. Simas C, Larson HJ, Paterson P. '"Those who do not vaccinate don't love themselves, or anyone else"': a qualitative study of views and attitudes of urban pregnant women towards maternal immunisation in Panama. BMJ Open. 2021;11(8):e044903. doi:10.1136/bmjopen-2020-044903

27. Wolff B, Aborigo RA, Dalaba M, et al. Community Barriers, Enablers, and Normative Embedding of Second Year of Life Vaccination in Ghana: A Qualitative Study. Glob Health Sci Pract. 2023;11(3). doi:10.9745/GHSP-D-22-00496

28. Gong D, Jiang Q, Chantler T, et al. Health System Barriers and Facilitators to Delivering Additional Vaccines through the National Immunisation Programme in China: A Qualitative Study of Provider and Service-User Perspectives. Vaccines. 2021;9(5):5. doi:10.3390/vaccines9050476

29. Stratoberdha D, Gobis B, Ziemczonek A, Yuen J, Giang A, Zed PJ. Barriers to adult vaccination in Canada: A qualitative systematic review. Can Pharm J Rev Pharm Can. 2022;155(4):206-218. doi:10.1177/17151635221090212

Peer Reviewed

Competing Interests: Authors declare no competing interest.

Funding: The study did not receive any funding.

Received: 13 June 2025; **Accepted:** 03 June 2026

Cite this article as WApary E, Cham MA, Jacob A, Alier K, Seriano FO, Sube K. Predictors of hepatitis B virus vaccine uptake among women of reproductive age, South Sudan: Conceptualising Health Belief Model. *East Afr Health Res J.* 2026;10(1):57-69. https://doi.org/10.24248/eahrj.v10i1.870