

Perceptions and Cues to Action as Predictors of Nurses' Vaccination Intentions at Two Primary Health Care Facilities in Ghana

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Abstract. Uptake of hepatitis B vaccination by health care providers remains suboptimal in Ghana, although it is considered an effective strategy against the hepatitis B virus. This study aimed to identify the predictors of nurses' hepatitis B vaccination intentions at two municipal health care facilities in Ghana. A descriptive cross-sectional survey was adopted. A section of the health belief model-based questionnaire was administered to 181 nurses conveniently sampled from the two facilities. Data analysis was done using Statistical Product and Service Solutions software version 23.0. Frequencies and percentages were used to assess the demographic characteristics of participants. Pearson *r* coefficients were used to assess the intercorrelations between individual perceptions, and the cues to action on vaccination intentions. Simple and multiple regression was used to estimate the prediction of individual perceptions, and the cues to action on hepatitis B vaccination intentions of nurses. The findings showed that nurse-perceived benefits and cues to action were positive and significantly related to hepatitis B vaccination intentions of nurses ($r = 0.14$, $P < 0.05$; $r = 0.17$, $P < 0.05$). Perceived susceptibility and perceived barrier were negative and significantly related to vaccine intentions ($r = -0.13$, $P < 0.05$; $r = -0.24$, $P < 0.01$). Notably, perceived barrier predicted hepatitis B vaccination intentions ($\beta = -0.22$, $t = -2.48$, $P = 0.01$). Nurses' vaccination behavioral intentions were positive. It was recommended that perceived barriers to hepatitis B vaccination such as vaccination ineffectiveness, time constraints, high costs, and side effects should be addressed to increase nurses' vaccination uptake.

INTRODUCTION

Hepatitis B virus (HBV) disease is a preventable viral infection that affects the liver.¹ A systematic review finding suggests an 8.36% prevalence of hepatitis B surface antigen among the adult population in Ghana.² Health care providers (HCPs) are classified as among the most at-risk group for hepatitis B infection because they often come into contact with blood and blood products.¹ Also, nurses form the majority of HCPs and are rated as being at higher risk due to their frequent involvement in invasive procedures and handling of biomedical waste.^{3,4} It is a general observation that nurses in Ghana work in resource-constrained settings where a lot of improvisation occurs and are daily exposed to contaminated sharps and blood and bodily fluids of patients. This is exemplified by a study in Kumasi Metropolis, where more than half (50.1%) of nurses are endangered by blood-borne viruses, specifically HBV, through needle stick-associated injuries.⁵ However, vaccination remains an effective strategy capable of preventing hepatitis B infection among HCPs.⁶

Uptake of hepatitis B vaccination among HCPs remains suboptimal in Ghana.⁷ For example, a study conducted among HCPs at the University of Ghana Hospital, Legon, identified a 53.4% vaccination rate among HCPs,⁷ which is much lower than the WHO-recommended 80% vaccine coverage for such high-risk personnel.⁸ Several factors account for hepatitis B vaccination uptake by HCPs.^{9,10} Common among the challenges are perceptions about risks, clinical value, and economic value held by providers.¹¹ In addition, insurance payment complexities, limited funding to support programs in vaccinating uninsured adults, higher prioritization of acute medical care needs over preventive services, inconsistent and or inadequate payment for vaccines, and

vaccine administration^{12,13} all contribute to the low adult vaccination uptake in Ghana. Arguably, identifying nurses' behavioral intentions will help them understand their future vaccinations.¹⁴

Recent studies have observed a positive and significant association between nurses' vulnerability to hepatitis B and vaccination intentions.^{15,16} Also, a few studies of HCPs discovered that those who perceived susceptibility to hepatitis B as high had a similarly high HBV vaccination rate.^{15,17,18} A similar situation was observed in Ethiopia, where HCPs' perceived risk of acquiring hepatitis B increased intentions to uptake the vaccines.¹⁷ It is, however, necessary to investigate the factors responsible for the suboptimal uptake of HBV vaccination among nurses because they form an integral part of clinical services in Nkwanta-South Municipality in Ghana. In addition, the few studies of hepatitis B vaccination among HCPs conducted in Ghana centered only on some urban settings.¹⁹ Hence, this study could enhance vaccination policy development by exploring the predictors of nurses' HBV vaccination intentions at two periurban primary health care facilities in the Oti region of Ghana.

MATERIALS AND METHODS

Study design. A quantitative descriptive cross-sectional survey was used. This study design offered the researcher the opportunity to collect data at one point in time from the sample or entire population of people.²⁰

Study setting. This study was conducted at two study sites in the Nkwanta-South Municipality. The two sites have a total bed capacity of 222 with a daily outpatient attendance of over 200. The hospital's human resources include nurses, doctors, laboratory technicians, radiology technicians, and other auxiliaries, with a total numerical strength of 501. Nurses, however, constituted 209 including professional nurses, professional midwives, registered nurse assistants, community health nurses, and registered community nurses.

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The facilities provide general health services including internal medicine, maternal and child health, radiology, laboratory, pharmacy, and mortuary services.

Inclusion criteria. Nurses of the two selected health facilities who have direct contact with a patient with hepatitis B (PWHB) or have ever nursed a PWHB during their practice were included. Direct contact represents touching the patient, their body fluids or wastes, and instruments used on the patients. Again, all nurses yet to take hepatitis B vaccination were included. Only those nurses available during the period of collection of data who consented were part of the study.

Exclusion criteria. Nurses with a self-report of a history of hepatitis B infection or already on treatment were excluded from this study. Nurses on rotation/national service were excluded from the study.

Sampling size and sampling method. Yamane (1967)²¹ contains the formula used to determine the sample size of nurses at the two selected facilities. A total of 181 participants was arrived at per the formula including a 10% non-response rate that was rounded up to 190 being recruited into the study from the two primary health care facilities. There was a response rate of 95.26%, because nine questionnaires were not returned. Nurses at the two facilities constituted the sample of the study. Additionally, the convenient sampling technique was used for 3 months to select the nurses until a total of 181 questionnaires was responded to. This was because this technique allowed only those who voluntarily were willing, accessible, and available to participate in the study.

Recruitment of participants. Participants were recruited between January and March 2020. Data collection took place during the same period. Participants who accepted being part of the study were informed of the purpose of the study. The consent form was given to those who agreed to fill out the questionnaire and a copy was given to them for future reference.

Data collection tools and procedure. A standardized structured questionnaire was used for the data collection that was based on the reviewed literature. The variables that constituted the instrument were adopted with the original scale having a Cronbach's alpha of > 0.70 (0.757–0.886).²² The sociodemographic information and knowledge of hepatitis B and hepatitis B vaccination were collected from participants using the questionnaire. The nature of the disease was solicited from the participants using questions such as "Does hepatitis B affects the liver?" The knowledge instrument had 15 items and participants were to answer all questions correctly for a total score of 15 points. A score of 0 to 5 was interpreted as poor, 6 to 10 was fair, and 11 to 15 was interpreted as good. The other variables on the instrument included hepatitis B vaccination uptake intention, with four items on the scale. The individual perception scales were the perceived susceptibility scale with five items, the perceived severity scale with five items, the perceived benefit scale with five items, and the perceived barriers scale with seven items. In addition, the cues to action scale had five items.

The Health Belief Model (HBM) constructs were measured using a seven-point Likert-type scale, ranging from 1 (strongly disagree) to 7 (strongly agree). For individual perception variables (perceived susceptibility, severity, and benefits), a higher score represents higher perceptions of

susceptibility to hepatitis B, the seriousness of the disease, and the benefits of getting HBV vaccination, respectively. Higher scores indicate positive responses. The perceived barrier to HBV vaccination was measured using lower scores from 4 to 1, neither agree nor disagree to strongly disagree, to represent negative responses indicating a lack of barriers, and, from 5 to 7, somewhat agree to strongly agree, to represent positive responses indicating barriers to HBV vaccination. Cues to action toward HBV vaccination were measured similarly using a seven-point Likert-type scale, ranging from 1 (strongly disagree) to 7 (strongly agree). A higher score represents positive responses indicating cues to action. For the hepatitis B vaccination uptake intentions scale, a higher score represents a higher intention to get the nurse vaccinated. This was recoded as follows: Points 3 to 1 represent no/low scores from somewhat disagree to strongly disagree, 4 represents undecided, and 5 to 7 represent (yes/high scores from somewhat agree to strongly agree.

The instrument was pretested with 30 nurses at a facility with the same characteristics as the selected study sites to test the reliability, of which the overall alpha was 0.817. The instrument's validity was ensured by subjecting it to expert review and extensive literature search.

The eligible population in the various units was given a 2-week notice about the study through the management of the health facilities. Those in charge of the wards were also informed officially before the start of data collection. Thereafter, with the use of the information sheet, the participants were briefed on the rationale for the study. Participants who met the inclusion criteria then formally signed the consent form. COVID-19 prevention protocols were observed. Two research assistants were recruited and trained by the principal investigator. The interested participants were assured of the confidentiality principle where no link was made available to trace participants to data and offered them the right to withdraw at any time deemed necessary. The questionnaires were left with the participants to submit independently. A safe box was provided to the respective wards for completed questionnaires to be placed immediately after the items had been responded to. Thereafter, the research assistants then collected the filled questionnaires once weekly until the period of 3 months elapsed.

Data analysis. The filled questionnaires were coded as 001, 002 to avoid double entry and misrepresentation. The completeness was also checked after they had been submitted by the research assistants. Frequencies of the data were run with IBM Statistical Product and Service Solutions (IBM-SPSS) software version 23.0 to identify any false entries or omissions in the dataset. A total of 190 questionnaires were administered to participants (nurses) in only two primary health care facilities. In total, 181 of the 190 questionnaires distributed were returned by participants, suggesting a 95.26% response rate. However, data screening and management with IBM-SPSS version 23.0 (Armonk, NY) revealed that 21 participants did not respond adequately to a substantial percentage of the questions and were thus excluded. Therefore, 160 valid questionnaires representing 84.21% were used for further and final analysis. Generally, it has been suggested that a decent response rate should be between 70% and 75%.²³ According to Babbie and Mouton,²⁴ a response rate of 50% is sufficient for statistical analysis, whereas a response rate of 70% or higher is considered

extremely good.²⁵ As a result, the current percentage of 84.2 is adequate for effective data processing and assessment. In all, four major analyses were done based on the research objectives. First, the researcher used frequencies and percentages to assess the sociodemographic characteristics of the participants. Second, skewness, kurtosis, mean, SD, and Cronbach's alpha were used to assess descriptive statistics (normality and reliability). Third, Pearson *r* coefficients were used to assess the intercorrelations among the individual perceptions and cues to action variables of HBV vaccination behavior intentions. Fourth, the simple and multiple regression, process model 4, and Sobel test of significant indirect effect by Hayes were used to assess the study objectives.²⁶ The statistical power and significance were set at the 0.05 significance level.

Ethical considerations. Ethical approval for the study was gained in August and November 2020 from two ethics review committees in Ghana. Permission was sought from the management of the two municipal hospitals to recruit participants for the study. The participants were allowed to sign the consent form after a detailed explanation was provided of the purpose of the study.

RESULTS

Sociodemographic characteristics of nurses. Key demographic characteristics included in the study were gender, marital status, educational qualification, professional rank, age, unit of work, and professional working experience. With an average professional working experience of 4.64 years, the stated minimum years of professional experience is a year and a maximum of 22 years. The average age was 31.20 years, with the youngest participating nurse being 22 years old and the oldest being 52 years old. The remaining attributes are listed in Table 1. There were slightly more females (54.40%) among the nurses investigated, with many of them being single (53.10%). The bulk of these nurses (51.30%) had a diploma and only a few (3%) had a specialty qualification. The ranks of the participants varied within the nursing and midwifery profession, with a slight majority (26.30%) being senior staff nurses and midwives. An appreciable number (19.40%) of them work in the male ward.

Assessment of normality and reliability of study variables. The normality of the study variables was examined. The normality determination was done to provide the basis for the use of parametric tests like regression. Skewness and kurtosis were used for normality determination using the ± 1 (normally distributed) and ± 2 (acceptable, not substantially deviated from normality) criteria (see Table 2).

Normality assessment. As observed from Table 2 above, the scores of hepatitis B vaccination uptake intention (the criterion) were normally distributed, with skewness and kurtosis falling within ± 1 . In addition, individual perception variables of perceived susceptibility, benefits, and severity scores were normally distributed, with skewness falling within ± 1 . A perceived barrier with a skewness value of 1.17 is acceptable because it is not substantially deviated from normality. Finally, cues to action were normally distributed, with scores falling within ± 1 .

Reliability assessment. The overall reliability coefficient of the questionnaire for nurses' HBV vaccination uptake intention was 0.83. In all, hepatitis B vaccination uptake

TABLE 1
Summary of findings from demographic characteristics of nurses

Characteristics	Frequency	Percentage
Gender		
Male	73	45.60
Female	87	54.40
Marital status		
Single	85	53.10
Married	75	46.90
Educational qualification		
Professional certificate	35	21.90
Diploma	82	51.30
Degree	38	23.80
Specialist certificate	5	3.00
Professional rank		
Enrolled nurse	33	20.60
Staff nurse/midwife	37	23.10
Senior staff nurse/midwife	42	26.30
Nursing/midwifery officer	24	15.00
Senior nursing officer	16	10.00
Principal nursing officer	6	3.80
Pediatric nurse	2	1.20
Unit of work		
Children's ward	21	13.10
Emergency ward	27	16.90
Female ward	21	13.10
Male ward	31	19.40
Outpatient department	26	16.30
Neonatal intensive care unit	11	6.90
Maternity ward	23	14.30

Sample size (N) = 160; professional experience (minimum = 1 year, maximum = 22 years, mean = 4.64 years, SD = 3.95 years); age (minimum = 22 years, maximum = 52 years, mean age = 31.20 years, SD = 5.25 years).

intention had the highest reliability coefficient ($\alpha = 0.96$), followed by a perceived barrier ($\alpha = 0.93$), perceived susceptibility ($\alpha = 0.75$), and perceived severity ($\alpha = 0.73$), with cues to action having the least reliability coefficient ($\alpha = 0.61$).

Assessment of intercorrelation matrix of study constructs. Relationships between individual perceptions, cues to action, and hepatitis B vaccination uptake intentions were examined using Pearson *r* correlation.

As observed in Table 3, there is a negative and significant relationship between perceived susceptibility and HBV vaccination uptake intention ($r = -0.13$, $P < 0.05$). The relationship between perceived severity and HBV vaccination uptake intention ($r = 0.11$, $P > 0.05$) was insignificant. Perceived benefits and cues to action had a positive and significant relationship with HBV vaccination uptake intention ($r = 0.14$, $P < 0.05$; $r = 0.17$, $P < 0.05$). The perceived barrier was negative and significantly related to HBV vaccination uptake intention ($r = -0.24$, $P < 0.01$). These outcomes are relationships that only show how the individual perceptions and cues to action relate to the HBV vaccination uptake

TABLE 2
Summary of normality and reliability coefficient (α) of the study variables

Study variables	Mean	SD	Skewness	Kurtosis	α
Perceived susceptibility	22.58	7.57	0.00	-1.01	0.75
Perceived severity	23.87	3.13	-0.96	1.42	0.73
Perceived benefits	24.99	2.40	-0.79	0.55	0.66
Perceived barrier	19.15	11.70	1.17	0.46	0.93
Cues to action	29.67	3.69	-0.78	1.37	0.61
Hepatitis B vaccination uptake intention	25.82	2.17	-0.59	-0.36	0.96

Overall alpha = 0.83.

TABLE 3
Summary of intercorrelations among individual perceptions, cues to action, and HBV vaccination uptake intentions of nurses

Predictors and Outcome Variables	1	2	3	4	5	6
Individual perceptions						
1. Perceived susceptibility	–	–	–	–	–	–
2. Perceived severity	0.12	–	–	–	–	–
3. Perceived benefits	0.07	0.28**	–	–	–	–
4. Perceived barrier	0.48**	0.01	–0.03	–	–	–
5. Cues to action	0.08	0.27**	0.12	0.05	–	–
Dependent variable						
6. Hepatitis B vaccination uptake intention	–0.13*	0.11	0.14*	–0.24*	0.17*	–

HBV = hepatitis B disease.
* $P < 0.05$, ** $P < 0.01$; $N = 160$.

intention; hence, they do not show prediction. These relationships were subjected to further analysis using multiple regression to identify which one predicts HBV vaccination uptake intention. Results are presented under the assessment of study variables.

Nurses' hepatitis B vaccination uptake intentions.

Nurses' hepatitis B vaccine uptake intentions were assessed using four questions. The questions assess a person's willingness to accept, begin, continue, and complete the vaccination process. Detailed results are presented in Table 4.

These nurses' responses indicate that they were willing to receive the vaccine (98.80%), start the vaccination (98.80%), continue the vaccination process (99.40%), and complete taking the HBV vaccine (100%). Thus, the nurses' responses indicate that the nurses' hepatitis B vaccination uptake intentions were positive.

Influence of individual perceptions (perceived susceptibility, severity, benefits, and barriers of HBV vaccination) on the hepatitis B vaccination uptake intentions of nurses. The model containing the individual perceptions (perceived susceptibility, severity, benefits, and barriers) was significant ($F_{(4, 155)} = 3.55$, $P = 0.01$, adjusted $R^2 = 0.06$) as shown in table 5. Perceived susceptibility, severity, benefits, and barriers together contributed 6% in explaining the variation of the HBV vaccination uptake intentions of nurses.

Perceived susceptibility predicting hepatitis B vaccination uptake intentions. The unstandardized b coefficient for perceived susceptibility ($b = -0.01$) shows that as the perceived susceptibility of the nurses increases a score value of, their HBV vaccination uptake intentions decrease by an extra 0.01 score; meaning, every additional increase in the perceived susceptibility of these nurses is associated with a decrease in hepatitis B vaccination uptake intentions. The standardized β for perceived susceptibility is -0.05 ; this gives important information regarding how perceived susceptibility performed in predicting HBV vaccination uptake intentions and contributing to the significant model observed. From Table 2, the SD for perceived susceptibility is 7.57. The beta score and the SD show that as the perceived susceptibility of the nurses increases by 7.57 SDs,

HBV vaccination uptake intentions decrease by 0.05 SDs. The SD for HBV vaccination uptake intentions, as observed in Table 2, is 2.17, and so this constitutes a change of 0.11 (0.05×2.17), meaning, anytime the perceived susceptibility level of the nurses concerning hepatitis B increases by a score of 7.57, there is a corresponding decrease in their vaccination uptake intentions by a score of 0.11. However, this outcome was found not to be statistically significant. Hence, this outcome shows that perceived susceptibility to hepatitis B failed to predict nurses' HBV vaccination uptake intentions ($\beta = -0.05$, $t = -0.53$, $P = 0.60$).

Perceived severity predicting hepatitis B vaccination uptake intentions.

The unstandardized b coefficient for perceived severity ($b = 0.06$) shows that as the perceived severity of the nurses increases a score value of, their HBV vaccination uptake intentions increase by an extra 0.06 score, meaning, for every additional increase in the perceived severity concerning hepatitis B by these nurses, there is an associated increase in HBV vaccination uptake intentions. The standardized β for perceived severity is 0.09; this gives vital information regarding how perceived severity predicts hepatitis B vaccination uptake intentions and contributes to the significant model observed. From Table 2, the SD for perceived severity is 3.13. The beta score and the SD show that as the perceived severity of the nurses increases by 3.13 SDs, HBV vaccination uptake intentions increase by 0.09 SDs. The SD for HBV vaccination uptake intentions, as observed in Table 2, is 2.17, and so this constitutes a change of 0.20 (0.09×2.17), meaning, anytime that the perceived severity level of the nurses concerning hepatitis B increases by a score of 3.13, there is a corresponding increase in their HBV vaccination uptake intentions by a score of 0.20. However, this outcome was found not to be statistically significant. Hence, the result shows that the perceived severity of hepatitis B failed to predict nurses' HBV vaccination uptake intentions ($\beta = 0.09$, $t = 1.11$, $P = 0.27$).

Perceived benefits predicting hepatitis B vaccination uptake intentions.

The unstandardized b coefficient for perceived benefit ($b = 0.10$) shows that as nurses' perception of benefits increases a score value of, their HBV vaccination

TABLE 4
Assessment of hepatitis B vaccination uptake intentions of nurses

Hepatitis B vaccination uptake intention items	Yes (%)	No (%)	Undecided (%)
I agree to receive the hepatitis B vaccine	158 (98.80)	1 (0.60)	1 (0.60)
I agree to start the hepatitis B vaccine series	158 (98.80)	–	2 (1.20)
I agree to return to the health facility for my 2nd or 3rd doses of the hepatitis B vaccine	159 (99.40)	–	1 (0.60)
I agree to complete vaccination against hepatitis B	160 (100.00)	–	–

$N = 160$.

TABLE 5
Summary of multiple regression showing prediction of HBV vaccination uptake intentions by individual perceptions

Predictor variables	Hepatitis B vaccination uptake intentions			
	<i>B</i>	β	<i>t</i>	Significance
Individual perceptions				
Susceptibility	-0.01	-0.05	-0.53	0.60
Severity	0.06	0.09	1.11	0.27
Benefits	0.10	0.11	1.31	0.19
Barrier	-0.04	-0.22	-2.48	0.01
ANOVA and model summary				
$F_{(4, 155)}$	-	-	3.55	0.01
<i>R</i>	-	-	0.29	-
R^2	-	-	0.08	-
Adjusted R^2 (%)	-	-	0.06	-

HBV = hepatitis B disease.

uptake intentions increase by an extra 0.10 score, meaning, for every additional increase in the perceived benefits concerning HBV vaccination by these nurses, there is an associated increase in HBV vaccination uptake intentions. The standardized β for perceived benefits is 0.11; this gives essential data regarding how perceived benefits performed in predicting HBV vaccination uptake intentions and contributing to the significant model observed. From Table 2, the SD for perceived benefits is 2.40. Using the beta score and the SD, it is observed that as the nurses' perceived benefits increase by 2.40 SDs, HBV vaccination uptake intentions increase by 0.11 SDs. The SD for hepatitis B vaccination uptake intentions, as observed in Table 2, is 2.17, and so this constitutes a change of 0.24 (0.11×2.17), meaning, anytime that the perceived benefits level of the nurses concerning the HBV vaccination increases by a score of 2.40, there is a corresponding increase in their vaccination uptake intentions by a score of 0.24. However, this outcome was found not to be statistically significant. Hence, the outcome shows that the perceived benefits of HBV vaccination failed to predict nurses' HBV vaccination uptake intentions ($\beta = 0.11$, $t = 1.31$, $P = 0.19$).

Perceived barrier predicting HBV vaccination uptake intentions. The unstandardized *b* coefficient for perceived barrier ($b = -0.04$) shows that as nurses' perception of the barrier to HBV vaccination increases a score value of, their HBV vaccination uptake intentions decrease by an extra 0.04 score, meaning, for every additional increase in the perceived barrier to HBV vaccination by these nurses, there is an associated decrease in HBV vaccination uptake intentions. The standardized β for the perceived barrier to HBV vaccination is -0.22 ; this gives crucial information regarding how the perceived barrier performed in predicting HBV vaccination uptake intentions and contributing to the significant model observed. From Table 2, the SD for the perceived

TABLE 6
Summary of simple linear regression showing the influence of cues to action on HBV vaccination uptake intentions

Predictor variable	Hepatitis B vaccination uptake intentions				
	<i>B</i>	Standard error	β	<i>t</i>	Significance
Cues to action	0.10	0.05	0.17	2.15	0.03
$F_{(1, 158)}$	-	-	-	4.61	0.03
R^2	-	-	-	0.03	-

HBV = hepatitis B disease.

barrier is 11.70. Using the beta score and the SD, it is observed that as nurses perceive the barrier to HBV vaccination increases by 11.70 SDs, HBV vaccination uptake intentions decrease by 0.22 SDs. The SD for HBV vaccination uptake intentions, as observed in Table 2, is 2.17, and so this constitutes a change of -0.48 (-0.22×2.17), meaning, anytime that the perceived barrier to HBV vaccination by nurses increases by a score of 11.70, there is a corresponding decrease in their vaccination uptake intentions by a score of 0.48. This outcome was found to be statistically significant. This finding demonstrates that a perceived barrier to HBV vaccination is associated with and predicted nurses' HBV vaccination uptake intentions ($\beta = -0.22$, $t = -2.48$, $P = 0.01$).

Even though all four individual perception variables (perceived susceptibility, severity, benefits, and barriers) were associated with HBV vaccination uptake intentions, only the perceived barrier to HBV vaccination predicted the nurses' vaccination uptake intentions. Nurses' hepatitis B vaccination uptake intentions fall when they anticipate barriers to HBV vaccination such as vaccination ineffectiveness, time constraints, high costs, the risk of harm is greater than the good, side effects, and remote vaccination centers.

Examination of the influence of cues to action to hepatitis B vaccination on hepatitis B vaccination uptake intentions of nurses. The model containing the cues to action was significant ($F_{(1, 158)} = 4.61$, $P = 0.03$, $R^2 = 0.03$) as shown in table 6.

The unstandardized *b* coefficient for cues to action ($b = 0.10$) shows that as nurses' cues to action increase a score value of, their HBV vaccination uptake intentions increase by an extra 0.10 score, meaning, for every additional increase in the cues to action of these nurses, there is an associated increase in HBV vaccination uptake intentions. The standardized β for the cues to action is 0.17; this gives crucial information regarding how cues to action are performed in predicting HBV vaccination uptake intentions and contributing to the significant model observed. From Table 2, the SD for the cues to action is 3.69. Using the beta score and the SD, it is observed that as nurses anticipate cues to action toward HBV vaccination increases by 3.69 SDs, HBV vaccination uptake intentions increase by 0.17 SDs. The SD for HBV vaccination uptake intentions, as observed in Table 2, is 2.17, and so this constitutes a change of 0.37 (0.17×2.17), meaning, anytime that cues to action toward HBV vaccination anticipated by nurses increase by a score of 3.69, there is a corresponding increase in their vaccination uptake intentions by a score of 0.37, which was statistically significant. This finding demonstrates that cues to action are associated with and predicted nurses' HBV vaccination uptake intentions ($\beta = 0.17$, $t = 2.15$, $P = 0.03$).

DISCUSSION

The study examined the individual perceptions and cues to action as predictors of nurses' hepatitis B vaccination intentions in one of the municipalities in Ghana. The study found that perceived susceptibility and barrier had a negative but significant relationship with HBV vaccination uptake intentions of nurses, supporting the findings of Ogundele et al.¹⁸ Typically, any increase in nurses' perceived susceptibility to hepatitis B could result in fewer intentions toward vaccine uptake and vice versa.¹⁸ Recent studies have

observed a positive and significant association between nurses' vulnerability to hepatitis B and vaccination intentions.^{15,16} However, the findings from the current study indicated otherwise. Perhaps the motivation for increasing nurses' intentions to vaccinate may not necessarily be solely the susceptibility to hepatitis B as the model postulated but protection of self, family, and patients. Additionally, evidence shows that longer work experience may result in a higher rate of exposure to various risky behaviors in the wards, which leads to a larger perceived risk of contracting a disease.¹⁷ Therefore, it is not surprising that most of the participants in this study have an average working experience of 5 years, which may have influenced their perceived susceptibility to hepatitis B.

Furthermore, a few other studies among HCPs discovered that those who perceived susceptibility to hepatitis B as high had a similarly high HBV vaccination rate.^{15,17,18} A similar situation was observed in Ethiopia, where HCPs' perceived risk of acquiring hepatitis B had increased intentions to uptake the vaccines.¹⁷ This outcome was demonstrated in this study. Participants admitted that although their bodies could fight off hepatitis B infection, they consider themselves at risk of contracting hepatitis B per their work. Other studies from Nigeria and Cameroon reported similar positive associations between perceived susceptibility and HBV vaccination intentions of nurses.^{18,27}

This study also shows that perceived barriers had a negative but significant relationship with HBV vaccination uptake intentions among nurses. This outcome is consistent with findings of a systematic review where a link was established between perceived barriers in terms of cost of the vaccine, for instance, and vaccination uptake intentions.²⁸ Another study done among the adult population in China also discovered the cost of vaccines and duration of protection related to vaccination uptake intentions.²⁹ This finding is in line theoretically with the original postulates of the HBM, which indicates that when the barrier is higher, there is a lower chance of adopting a new behavior and vice versa.³⁰ According to Guo et al.,²⁹ participants who had low perceived barriers considering 99% HBV vaccine protection rate, 20-year duration of protection, minimal risk of side effects, and moderate cost of vaccination were more likely to pay and get themselves vaccinated. The current study's finding suggests that nurses' low impression of the cost of the vaccine, side effects, and effectiveness of the vaccine and vaccination centers being not far from the workplace may have accounted for the increase in HBV vaccination intentions. Again, on the perceived barrier relationship with HBV vaccination uptake intentions of nurses, this study disagrees with a study that reported a significant positive relationship between the perceived barrier and willingness to pay (WTP) for HBV vaccination.²² Participants' high perceived barrier was associated with greater WTP for HBV vaccination. This finding differs from what the researchers had in this present study.

This study also discovered that perceived benefits were positive and significantly related to vaccination uptake intentions. This outcome shows that the more nurses perceive HBV vaccination as good and beneficial, the more they may have preferred to be vaccinated. This observation concurs with the findings of a study among Finnish HCPs.³¹ The vaccination uptake among the HCPs was high (86.2%), which was linked to the positive impact of the mandatory vaccination policies in some European countries and the consequences

of not being vaccinated. In Ghana, even though adult vaccination is voluntary, as in the case of Nigeria in the subregion, the benefits of vaccination, which included protection of self, patients, and families from being infected with additional immunity, may have contributed to the positive correlations for the high HBV vaccination uptake intentions.³²⁻³⁴ This observation was evident in the reports of this study, where participants recorded strong agreement with these perceived benefit items. Findings from this study supported another finding that reported that vaccine safety was the most relevant perceived benefit that was related and predicted vaccination uptake intentions.^{35,36} More so, the desire of HCPs to protect their family members from being infected was correspondingly higher with vaccination uptake intentions. However, these findings were not consistent with two studies in Asia. One explored determinants of vaccine uptake by nurses regarding recommended vaccines such as hepatitis B (Hep B); influenza; measles, mumps and rubella (MMR); varicella, and diphtheris-tetanus-pertussis (DTaP) vaccines in Taiwan⁴ and HBV vaccine acceptability in Iran.³⁷ Perceived benefits of the vaccine were found to be statistically insignificant and correspondingly resulted in lower vaccination uptake.

Even more so, this study found that perceived severity had no significant relationship with HBV vaccination uptake intentions among nurses. Studies reported differing results as the perceived severity of HCPs was significantly associated with vaccination.^{35,36} This study reported that nurses perceived hepatitis B as serious, that they were personally at risk, and could lead to death. Nevertheless, the present finding is inconsistent with Abiye et al.'s study conducted in India among HCPs to assess their willingness to pay for HBV vaccination.³⁸ It was found that perceived severity, which was linked with the experience of managing people living with hepatitis B (PLWH), was significantly associated with WTP for HBV vaccination. Those who work more with PLWH, especially in hospitals, were more likely to have WTP for HBV vaccination. The constant exposure to patients relates to the seriousness of the disease. Among all the individual perceptions, only the perceived barrier predicted HBV vaccination uptake intentions of nurses in the present study. This finding is consistent with studies among HCPs, which further corroborate the results of a systematic review where perceived seriousness relates to vaccination uptake intentions.³⁹ The current finding suggests that nurses possibly prioritized the intentions of HBV vaccination over the perceived barriers, even though some participants were concerned.

In this study, cues to action toward HBV vaccination were positive and significantly related to hepatitis B vaccination uptake intentions. Cues to action of the participants were the prompts that enhanced their vaccination uptake, which involved concerns about family and friends, for instance, getting vaccinated with the HBV vaccine. This finding on the positive relationship with vaccination uptake intentions supports a study conducted among HCPs in Iran that assessed predictors of HBV preventive behavioral intentions.⁴⁰ This study reported a significant positive contribution of cues to action to nurses' vaccination intentions. Hepatitis B-related information from fellow HCPs and possible restriction from patient care if infected were the most relevant cues to action reported by this study, which is also in line with findings from several settings, including Turkey, Australia, Iran, and Italy.^{34,40-42} In the present study, the majority (51.3%) had

diplomas. The education at that level is sufficient to equip practitioners with requisite information on hepatitis B and HBV vaccination in Ghana, which may have influenced participants' behavioral intentions.

This study found that nurses' hepatitis B vaccination uptake behavioral intentions were positive. The majority (> 95%) of the nurses indicated their positive intentions to be vaccinated, as in the case of a related study that was conducted in Nigeria.¹⁸ This outcome is in line with another study that found a strong association between behavioral intentions to uptake vaccine and an actual vaccination rate of 35%.¹⁴ The participants with higher intentions correspondingly had a relatively high vaccination rate.¹⁴ The more vaccination intentions were perceived, the higher the vaccination rates recorded. This finding from the present study probably resulted from nurses' greater knowledge and a positive intentions demonstrated. This study reported nurses' readiness to initiate the vaccination process, continue, and complete it. Furthermore, the positive vaccination intentions reported in this study differ from a study conducted in California, which recorded nurses' low vaccination uptake intentions.⁴³

CONCLUSION

Hepatitis B vaccination is still the mainstay preventive measure for hepatitis B and is of concern to nurses. However, nurses have varied and numerous factors that are responsible for their HBV vaccination intentions. Individual perceptions and cues to action helped to explain the various factors that affected nurses' vaccination intentions in Nkwanta-South Municipality in the Oti region of Ghana.

The findings disclosed that nurses' perceived susceptibility toward hepatitis B and barriers to HBV vaccination were negative and significantly related to HBV vaccination uptake intention. Significant among the barriers were cost, vaccine safety, unavailability of vaccine, distance, and so forth. The researchers believed that hospital management could make many attempts to minimize the barriers to vaccine intentions of the staff. Additionally, nurses' perceived benefits and cues to action toward HBV vaccination were positive and significantly related to vaccine uptake intention. For perceived benefits, most nurses claimed that the vaccine protects them, their patients, and their families from being infected. However, among the individual perceptions of nurses, the perceived severity of hepatitis B did not have any significant relationship with HBV vaccination uptake intention. Thus, the relationships between the severity of HBV and the vaccination uptake intentions of nurses were weak. Nevertheless, the nurses had positive hepatitis B vaccination uptake behavior intentions, which were accounted for by the HBM. This outcome predicts actual future vaccinations. This study concludes that nurses' vaccination uptake intentions may continuously improve when there is a conscious effort to increase the affordability and availability of the hepatitis B vaccine and health education on hepatitis B.

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REFERENCES

1. World Health Organization, 2019. *Hepatitis B Fact Sheet*. Available at: <https://www.who.int/news-room/fact-sheets/detail/hepatitis-b>. Accessed February 20, 2020.
2. Abesig J, Chen Y, Wang H, Sompo FM, Wu IX, 2020. Prevalence of viral hepatitis B in Ghana between 2015 and 2019: a systematic review and meta-analysis. *PLoS One* 15: e0234348.
3. Alese OO, Alese MO, Ohunakin A, Oluyide PO, 2016. Seroprevalence of hepatitis B surface antigen and occupational risk factors among health care workers in Ekiti State, Nigeria. *J Clin Diagn Res* 10: 16–18.
4. Chen IH, Hsu SM, Wu JJ, Wang YT, Lin YK, Chung MH, Huang PH, Miao NF, 2019. Determinants of nurses' willingness to receive vaccines: application of the health belief model. *J Clin Nurs* 28: 3430–3440.
5. Obirikorang C et al., 2019. Awareness and occupational exposures to needlestick injuries among healthcare workers: a quantitative assessment in a Ghanaian metropolis. *Glob J Qual Saf Healthc* 2: 70.
6. World Health Organization, 2013. *Global Plan of Action on Workers' Health (2008–2017): Baseline for Implementation*. Available at: <https://www.who.int/publications/i/item/WHO-FWC-PHE-2013-01>. Accessed September 9, 2020.
7. Ansa GA, Ofori KNA, Houphouet EE, Amoabeng AA, Sifa JS, Amenuveve CK, Odame GH, 2019. Hepatitis B vaccine uptake among healthcare workers in a referral hospital, Accra. *Pan Afr Med J* 33: 96.
8. World Health Organization Regional Office for Europe, 2017. *Action Plan for the Health Sector Response to Viral Hepatitis in the WHO European Region*. Available at: <https://apps.who.int/iris/handle/10665/344154>. Accessed November 20, 2020.
9. Bonville CA, Domachowski JB, Cibula DA, Suryadevara M, 2017. Immunization attitudes and practices among family medicine providers. *Hum Vaccin Immunother* 13: 2646–2653.
10. Albright K, Hurley LP, Lockhart S, Gurfinkel D, Beaty B, Dickinson LM, Libby A, Kempe A, 2017. Attitudes about adult vaccines and reminder/recall in a safety net population. *Vaccine* 35: 7292–7296.
11. Hurley LP et al., 2016. Physician attitudes toward adult vaccines and other preventive practices, United States, 2012. *Public Health Rep* 131: 320–330.
12. Williams WW et al., 2016. Surveillance of vaccination coverage among adult populations—United States, 2014. *MMWR Surveill Summ* 65: 1–36.
13. Bridges CB, Hurley LP, Williams WW, Ramakrishnan A, Dean AK, Groom AV, 2015. Meeting the challenges of immunizing adults. *Am J Prev Med* 49: S455–S464.
14. Cha KS, Kim KM, 2019. The factors related to mothers' intention to vaccinate against hepatitis A: applying the theory of planned behavior. *Child Health Nurs Res* 25: 1–8.
15. Kusic-Tepavcevic D, Kanazir M, Gazibara T, Maric G, Makismovic N, Loncarevic G, Pekmezovic T, 2017. Predictors of hepatitis B vaccination status in healthcare workers in Belgrade, Serbia, December 2015. *Euro Surveill* 22: 30515.
16. Wilson R, Zaytseva A, Bocquier A, Nokri A, Fressard L, Chamboredon P, Carbonaro C, Bernardi S, Dubé E, Verger P, 2020. Vaccine hesitancy and self-vaccination behaviors among nurses in southeastern France. *Vaccine* 38: 1144–1151.
17. Akibu M, Nurgi S, Tadese M, Tsega WD, 2018. Attitude and vaccination status of healthcare workers against hepatitis B

- infection in a teaching hospital, Ethiopia. *Scientifica* 2018: 6705305. doi:10.1155/2018/6705305.
18. Ogundele OA, Fehintola FO, Adegoke AI, Olorunsola A, Omotosho OS, Odia B, 2017. Perceived risk, willingness for vaccination and uptake of hepatitis B vaccine among health care workers of a specialist hospital in Nigeria. *Public Health Res* 7: 100–105.
 19. Ofori-Asenso R, Agyeman AA, 2016. Hepatitis B in Ghana: a systematic review & meta-analysis of prevalence studies (1995–2015). *BMC Infect Dis* 16: 130.
 20. Creswell JW, 2014. *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. Thousand Oaks, CA: SAGE Publications.
 21. Yamane T, 1967. *Statistics: An Introductory Analysis, 2nd ed.* New York, NY: Harper and Row.
 22. Rajamoorthy Y, Radam A, Taib NM, Rahim KA, Wagner AL, Mudatsir M, Munusamy S, Harapan H, 2018. The relationship between perceptions and self-paid hepatitis B vaccination: a structural equation modeling approach. *PLoS One* 13: e0208402.
 23. Cohen J, 1988. *Statistical Power Analysis for the Behavioral Sciences*. Hillsdale, NY: Lawrence Erlbaum Associates.
 24. Babbie E, Mouton J, 2001. *The Practice of Social Research: South African Edition*. Cape Town, South Africa: Oxford University Press Southern Africa.
 25. Babbie E, Mouton J, 2001. *The Practice of Social Research*. Cape Town, South Africa: Oxford University Press, Southern Africa.
 26. Hayes AF, 2018. *Introduction to Mediation, Moderation, and Conditional Process Analysis: A Regression-Based Approach*. New York, NY: Guilford Publications.
 27. Tatsilong HOP, Noubiap JNN, Nansseu JRN, Aminde LN, Bigna JJR, Ndze VN, Moyou RS, 2016. Hepatitis B infection awareness, vaccine perceptions and uptake, and serological profile of a group of health care workers in Yaoundé, Cameroon. *BMC Public Health* 16: 706.
 28. Michaels-Igbokwe C, MacDonald S, Currie GR, 2017. Individual preferences for child and adolescent vaccine attributes: a systematic review of the stated preference literature. *Patient* 10: 687–700.
 29. Guo N, Wang J, Nicholas S, Maitland E, Zhu D, 2020. Behavioral differences in the preference for hepatitis B virus vaccination: a discrete choice experiment. *Vaccines (Basel)* 8: 527.
 30. Rosenstock IM, 1974. The health belief model and preventive health behavior. *Health Educ Monogr* 2: 354–386.
 31. Karlsson LC, Lewandowsky S, Antfolk J, Salo P, Lindfelt M, Oksanen T, Kivimäki M, Soveri A, 2019. The association between vaccination confidence, vaccination behavior, and willingness to recommend vaccines among Finnish healthcare workers. *PLoS One* 14: e0224330.
 32. Dokurugu YM, Duah E, Agoni C, Kumi Oduro R, Dadzie Ephraim RK, Essien-Baidoo S, 2019. Post-vaccination epidemiological analysis of hepatitis “B” viral infection among selected communities in the central region of Ghana. *Am J Biomed Sci Res* 4: 150–153.
 33. Brewer NT, Chapman GB, Rothman AJ, Leask J, Kempe A, 2017. Increasing vaccination: putting psychological science into action. *Psychol Vaccin* 18: 149–207.
 34. Harrison N, Brand A, Forstner C, Tobudic S, Burgmann K, Burgmann H, 2016. Knowledge, risk perception and attitudes toward vaccination among Austrian health care workers: a cross-sectional study. *Hum Vaccin Immunother* 12: 2459–2463.
 35. Corace K, Prematunge C, McCarthy A, Nair RC, Roth V, Hayes T, Suh KN, Balfour L, Garber G, 2013. Predicting influenza vaccination uptake among health care workers: what are the key motivators? *Am J Infect Control* 41: 679–684.
 36. Cheung K, Ho SMS, Lam W, 2017. Factors affecting the willingness of nursing students to receive annual seasonal influenza vaccination: a large-scale cross-sectional study. *Vaccine* 35: 1482–1487.
 37. Mirzaei Alavijeh M, Vaezi M, Jalilian F, 2018. Hepatitis B vaccine acceptability among nurses: a theory based conceptualization. *Middle East J Dig Dis* 11: 45–51.
 38. Abiye S, Yitayal M, Abere G, Adimasu A, 2019. Health professionals’ acceptance and willingness to pay for hepatitis B virus vaccination in Gondar City Administration governmental health institutions, northwest Ethiopia. *BMC Health Serv Res* 19: 796.
 39. Carpenter CJ, 2010. A meta-analysis of the effectiveness of health belief model variables in predicting behavior. *Health Commun* 25: 661–669.
 40. Morowatishaifabad MA, Zare Sakhvidi MJ, Gholianavval M, Masoudi Boroujeni D, Mirzaei Alavijeh M, 2015. Predictors of hepatitis B preventive behavioral intentions in healthcare workers. *Saf Health Work* 6: 139–142.
 41. Napolitano F, Bianco A, D’Alessandro A, Papadopoli R, Angelillo IF, 2019. Healthcare workers’ knowledge, beliefs, and coverage regarding vaccinations in critical care units in Italy. *Vaccine* 37: 6900–6906.
 42. Asma S et al., 2016. Factors effecting influenza vaccination uptake among health care workers: a multi-center cross-sectional study. *BMC Infect Dis* 16: 192.
 43. Gonzales R, Glik D, Prelip M, Bourque L, Yuen J, Ang A, Jones M, 2006. Risk perceptions and behavioral intentions for hepatitis B: how do young adults fare? *Health Educ Res* 21: 654–661.