



Impact of Behaviour Change Communication on Uptake of Hepatitis B Vaccination among Health Workers in Fako Division, Cameroon

Serge Ngekegeng^{1*}, Alain Chichom-Mefire², Nicholas Tendongfor¹, Esembeson Malika¹, Margaret Ebob-Bessem¹, Simeon Pierre Choukem³

¹Department of Public Health and Hygiene, University of Buea, Buea, Cameroon

²Department of Obstetrics and Gynecology, University of Buea, Buea, Cameroon

³Faculty of Medicine and Pharmaceutical Sciences, University of Dschang, Dschang, Cameroon

Email: *sergengekeng@gmail.com

How to cite this paper: Ngekegeng, S., Chichom-Mefire, A., Tendongfor, N., Malika, E., Ebob-Bessem, M. and Choukem, S.P. (2024) Impact of Behaviour Change Communication on Uptake of Hepatitis B Vaccination among Health Workers in Fako Division, Cameroon. *Open Access Library Journal*, 11: e11084.

<https://doi.org/10.4236/oalib.1111084>

Received: December 6, 2023

Accepted: January 27, 2024

Published: January 30, 2024

Copyright © 2024 by author(s) and Open Access Library Inc.

This work is licensed under the Creative Commons Attribution International License (CC BY 4.0).

<http://creativecommons.org/licenses/by/4.0/>



Open Access

Abstract

Background: Despite WHO estimates of two million healthcare workers (HCWs) who are exposed to hepatitis B virus (HBV) yearly, uptake of the hepatitis B vaccine among HCWs in Cameroon is low. **Objective:** Our study aimed at testing the effectiveness of a behaviour change communication (BCC) intervention in improving vaccination uptake among HCWs in Fako Division. **Methods:** We carried out a clustered randomized controlled trial involving HCWs in 12 study hospitals and 12 control hospitals. Baseline vaccination uptake was established for both groups and a 6month BCC intervention applied to the study group. After 6months, uptake was again measured for both groups. We performed the adjusted chi-square tests to compare between groups and within groups from baseline to end of study. **Results:** Greater than 1 dose vaccination uptake increased from 25.66% to 34.72% (p value, 0.02) in the control group and from 35.27% to 75.89% (p value, <0.001) in the study group, meanwhile ≥ 3 dose uptake increased from 8.68% to 27.92% (p value, <0.001) in the control group and from 17.86% to 65.63% (p value, <0.001) in the study group. The change in the intervention group was significantly higher than that in the control (p value, <0.001). Posters and brochures reached 93.8% of participants while 35.9% said they got vaccinated because of the work station visits. **Conclusion:** BCC is effective in increasing hepatitis B vaccination uptake among HCWs. Public health officials should utilize wide-reaching as well as more interactive channels of BCC to improve vaccination among HCWs.

Subject Areas

Infectious Diseases, Public Health

Keywords

Hepatitis B, Vaccination, Behaviour Change Communication, Health Care Workers

1. Introduction

In 2015, WHO projected that about 257million people with chronic hepatitis B were alive with a global annual mortality attributable to hepatitis B virus (HBV) infection of about 887,000 deaths [1]. Sub-Saharan Africa has a particularly high HBV infection prevalence and according to different studies, values range between 7% - 26% in different countries [2] [3]. Since HBV infection is communicable from person to person through blood and other body fluids, health care workers (HCWs) are particularly at high risk of HBV infection through occupational exposure [4] [5]. WHO estimates that about two million HCWs are exposed each year and sub-Saharan Africa and other low-income countries account for about 90% of the infections resulting from these exposures [6]. Percutaneous occupational exposure has been reported to be responsible for 40% - 65% of HBV infections in healthcare workers in developing countries compared to less than 10% in developed countries due mostly to proper immunization and postexposure prophylaxis [7]. Despite the availability of a potent vaccine against Hepatitis B since 1982, uptake among adults remains very low in developing nations [8] [9]. Unvaccinated individuals have a 6% to 30% chance of getting infected with HBV once exposed to blood and body secretions of infected persons [10]. According to WHO, among HCWs, HBV vaccination uptake in low and middle income countries is only 18% - 39% against 67% - 79% in high income countries [11]. In Cameroon, few studies have investigated the epidemiology of HBV in HCWs. Previous studies have shown a hepatitis B uptake of only 24.5% among surgical residents [12], 18% among medical students in clinical years [13], and 19% in general HCWs [14]. We had earlier reported a hepatitis B vaccine uptake of only 27.4% among HCWs in Fako Division, Cameroon irrespective of the number of doses with only 12.9% having received complete vaccination of at least 3 doses [15].

Many scholars have not given interest to assessing knowledge and perceptions among HCWs concerning HBV and the vaccine, and a some of these studies done show a good knowledge that is usually contrasted with poor preventive practices against infection however [16] [17]. Improving the uptake of hepatitis B vaccine among health care workers is for a dual purpose of protecting the HCWs and to reduce the risk of infecting patients under their care and given the contrast in knowledge and vaccine uptake, traditional educational methods may not be sufficient.

Education for health workers has been done to improve the uptake of flu vaccines both for themselves as health workers and for their patients [18]. Tradi-

tional educational methods, however, have had mixed reports with some studies reporting a significant impact in increasing vaccination knowledge among HCWs [19], but other studies report no significant impact on vaccination uptake [20]. Active or participatory methods rather than passive methods of education have been shown to be more effective in changing health outcomes [18]. Health education approaches like behavior change communication (BCC) are said to help people make intelligent choices about their health and the quality of life of their community [21]. Behaviour Change Communication has been defined as an interactive process of intervention with individuals, groups, or communities to develop communication strategies to promote positive health behaviours which are appropriate to the current social conditions and thereby help the society to solve their pressing health problems [22]. Researchers working on BCC have reported prolonged behaviour change in different aspects of healthcare, like maternal-child health, nutrition, sexually transmitted diseases, and others [23] [24] [25].

The impact of BCC on hepatitis B vaccine uptake among HCWs has not been assessed by any study to the best of our knowledge. We carried out a baseline survey to measure the hepatitis B vaccination uptake and its determinants in Fako division (15) with the aim of using the findings to develop our BCC intervention. The aim of this study was to design a context specific BCC intervention and to test its impact on hepatitis B vaccine uptake among HCWs in Fako Division.

2. Methods

2.1. Study Design and Setting

We carried out a cluster randomized controlled trial involving selected hospitals in the Fako Division of the South West Region of Cameroon. The Fako Division includes the South West regional capital city Buea, and the city of Limbe, a major touristic attraction and spread between both cities are the two regional hospitals of the region. Because our BCC was to be carried out by both, methods that address individual HCWs and those that address all HCWs within a hospital, we had to randomize our participants according to the clusters which in our case are the hospitals. Our study included 24 purposively selected hospitals (10 public and 24 private) on the basis of staff strength and the level of the hospital, drawn from the four health districts of the Division. The health workers in these hospitals deal with the widest array and the most severe of cases from all over the region.

2.2. Participants

The study was carried out among health workers who were at least 18 years of age and duly employed or in at least a year-long internship in one of the study hospitals. We recruited health workers in 24 hospitals within the Fako Division whose management agreed to participate in the study. Twelve of these hospitals found in Buea and Muyuka Health districts were assigned to the intervention

arm and the other 12 institutions which were in the Limbe and Tiko health Districts served as control hospitals. Randomization was done according to Health Districts in order to avoid spillover of the intervention to health workers recruited in the control group. All technical staff (Doctors, nurses, laboratory scientists, pharmacists, and radiologists) and cleaners of the participating hospitals were offered participation in the study. There were in total 224 health workers in the intervention hospitals who consented to the study and 265 in the control hospitals.

2.3. Intervention

We carried out a behaviour change communication (BCC) educational intervention. Materials used for behaviour change communication included brochures, posters, and video recording carrying messages that outline the risks and dangers of hepatitis B for health workers and the benefits of taking the vaccine. The BCC materials' content was based on existing literature and additional factors identified from our baseline survey. The BCC program was designed in such a way that it can be incorporated into hospitals' programs to raise Hepatitis B vaccine uptake. To develop the BCC materials and channels, we used a modified Delphi approach [26] whereby we asked for many rounds of structured feedback from key stakeholders including health care workers and our research team members. We shared the feedback among the stakeholders until a consensus was reached. Participants commented on the clarity and relevance of BCC content and the suitability of BCC channels.

The intervention was carried out for a 6 month period in all intervention hospitals. Posters were posted in all working stations and offices within the intervention hospitals. Brochures were handed to all participating health workers. Trained research assistants presented health talks at the monthly departmental meetings in all intervention hospitals, during one of which a testimonial video was played of a nurse who had become infected and was suffering from hepatitis B. The research assistants also performed monthly visits to the workstations and offices to give brief talks and engage with participants. Messages were also sent to departmental WhatsApp groups for the various departments involved within the study hospitals. An additional factor in intervention hospitals was the reassurance that there was always a supply of hepatitis B vaccine at the hospital pharmacy. We monitored the stock in collaboration with the pharmacists and ensured there was always a supply for research purposes. None of these activities were carried out in the control hospitals.

Our message highlighted the prevalence of hepatitis B, the high resistance of the virus out of the body, the liver destroying capacity of the virus, and the lack of treatment for the disease as risk perception awakening components. The other component of our message included information about hepatitis B vaccine, its availability, its safety, addressing the notion of high costs, and extreme adverse effects to bring participants to see the benefits of vaccination as a way higher

than the barriers thus increasing the uptake of vaccination.

2.4. Ethical Consideration

Ethical clearance for the study was obtained from the Institutional ethics committee for research on human health of the University of Douala (N°1254IEC-UD/02/2018/T). Participants signed an informed consent form before being enrolled into the study. Participation in the study was voluntary. Participants were assigned unique codes to ensure confidentiality.

2.5. Data Collection

A questionnaire was used to abstract data from participants on their knowledge of hepatitis B, their vaccination status, and other variables pre and post the intervention period. We asked to know if participants had taken at least one dose of the hepatitis B vaccine, which we called ≥ 1 dose vaccination uptake. We also sought to know if participants had completed at least 3 doses of the hepatitis B vaccine as recommended for a complete vaccination and we called this ≥ 3 dose vaccination uptake. These two types of vaccine uptake are reported separately. The pre-intervention questionnaire also collected data on the barriers to hepatitis B vaccination uptake among participants who had not been vaccinated, while the post-intervention one included questions on the most effective BCC channel for each participant.

2.6. Data Management and Analysis

Questionnaire copies were cross-checked once they were brought to the site for completeness and edited for the use of correct codes by the principal investigator. A code was given to identify each participant. The CONSORT guidelines were followed in the analysis of the data. Baseline characteristics were presented separately for each study arm. Descriptive statistics were used to summarize participants' demographics. The adjusted chi-square test was used to compare groups for binary outcomes, and t-test corrected for clustering was used to compare groups for continuous outcomes. We carried out a difference-in-difference analysis to compare the change in vaccination uptake in the intervention group with that in the control group. All statistical tests were performed using two-sided tests at the 0.05 level of significance.

3. Results

3.1. Sociodemographic Characteristics of Participants

There were 224 respondents in the intervention group and 265 in the control group. Participants' ages ranged from 18 years to 69 years with a mean age of 33.6 ± 10.00 years. There were more women than men in both the intervention group (66.52%) and the control group (78.49%). Only around 23% of both control and intervention participants worked in hospitals with a known official policy on hepatitis B vaccination for employees. This is shown on **Table 1**.

Table 1. Socio-demographic characteristics of intervention and control group participants.

Characteristic	Intervention group (n = 224), n (%)	Control group (n = 265), n (%)
Age (years)		
18 - 29	126 (56.25)	95 (35.85)
30 - 50	89 (39.73)	146 (55.09)
>50	9 (4.02)	24 (9.06)
Sex		
Male	75 (33.48)	57 (21.51)
Female	149 (66.52)	208 (78.49)
Profession		
Doctor	24 (10.71)	16 (6.04)
Nurse	138 (61.61)	150 (56.60)
Lab scientist	42 (18.75)	60 (22.64)
Cleaner	15 (6.70)	26 (9.81)
Others	5 (2.23)	13 (4.91)
Work experience (years)		
0 - 5	149 (66.52)	126 (47.55)
6 - 10	45 (20.09)	73 (27.55)
>10	30 (13.39)	66 (24.91)
Income (XAF)		
<100,000	166 (74.11)	150 (56.60)
100,000 - 200,000	39 (17.41)	88 (33.21)
>200,000	19 (8.48)	27 (10.19)
Sector		
Public	120 (53.57)	141 (53.21)
Private	104 (46.43)	124 (46.79)
Vaccination policy		
Yes	52 (23.21)	63 (23.77)
No	172 (76.79)	202 (76.23)

3.2. Barriers to Hepatitis B Vaccination Uptake among Participants

At baseline, respondents in both study arms who were not yet vaccinated were asked to state reasons for which they had not been vaccinated. The most cited reason was lack of awareness about the need (35.42%), lack of finances (25.89%), and lack of availability of vaccine within health facility (24.40%). The least cited

reasons were lack of trust in vaccination (9.23%) and a negligent attitude towards the vaccine (5.06%). This is shown in **Figure 1**.

3.3. Impact of BCC on Participant's Knowledge of Hepatitis B

Participants' knowledge on various aspects about hepatitis B was measured before the intervention and again at the end of the intervention using the same questionnaire. General knowledge about hepatitis B was evaluated on 10, knowledge on hepatitis B transmission evaluated on 9, knowledge on hepatitis B vaccine evaluated on 10, and lastly knowledge on post-exposure management of hepatitis B was evaluated on 6 making a total of 34. At baseline, the mean knowledge score on 34 was 26.23 for the intervention group and 26.64 for the control group. There was a significant change in both overall knowledge score and individual knowledge categories from baseline to the endpoint for the intervention group (all $p < 0.001$) as opposed to no significant change in the control group (**Table 2**).

3.4. Impact of BCC on Vaccination Uptake

At baseline, for the intervention group, only 35.27% of participants had taken at

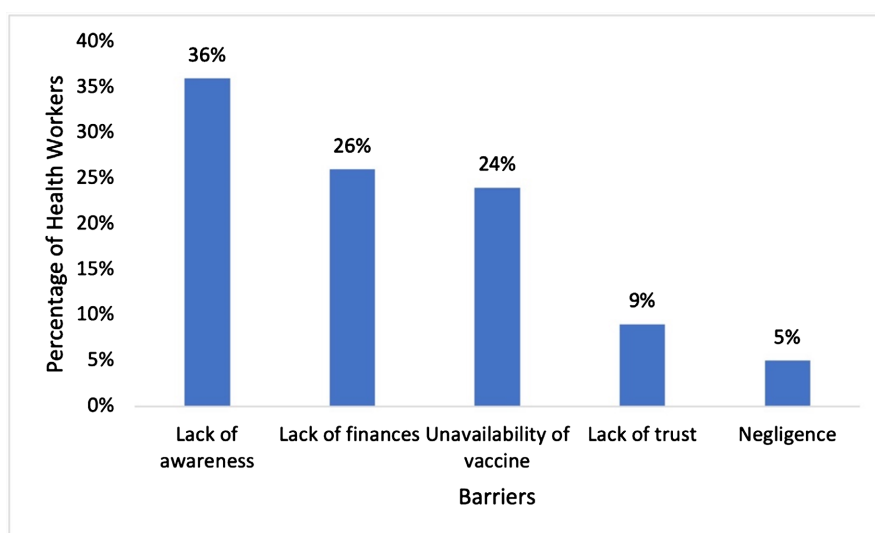


Figure 1. Barriers to vaccination uptake among HCWs.

Table 2. Impact of intervention on hepatitis B knowledge of HCWs.

Hepatitis B knowledge	Intervention group n = 224			Control group n = 265		
	Baseline mean (SD)	End of study mean (SD)	<i>p</i> value	Baseline mean (SD)	End of study mean (SD)	<i>p</i> value
General awareness	8.36 (1.55)	8.95 (1.31)	<0.001	8.66 (1.53)	8.84 (1.51)	0.170
Modes of transmission	6.93 (1.88)	7.71 (1.66)	<0.001	6.95 (1.89)	7.10 (1.84)	0.351
Hepatitis B vaccine	6.71 (1.84)	7.64 (1.92)	<0.001	6.83 (1.91)	7.03 (1.94)	0.233
Post exposure management	4.23 (0.96)	4.57 (0.69)	<0.001	4.20 (1.02)	4.26 (0.96)	0.480
Total	26.23 (4.10)	28.86 (4.0)	<0.001	26.64 (4.60)	27.19 (4.41)	0.158

least one dose of the hepatitis B vaccine with only 17.86% having completed all 3 recommended doses. For the control group, baseline at-least-one-dose coverage was 25.66% and at least-3-dose coverage was 8.68%. There was a significant change in vaccination uptake both in the intervention and control group. However, the change in the intervention group was very significantly higher than that in the control group from the difference-indifferences analysis (all $p < 0.001$) (Table 3).

3.5. Impact Analysis of the Different Channels Used for BCC

Respondents in the intervention group who got vaccinated within the study period (91 participants) were asked to identify the communication channels that reached them and select the one that most influenced their decision to vaccinate. Of the 4 channels used in our intervention, posters and brochures reached the most number of participants (93.8%) but had the least number of attributable vaccination decisions, only 10% of all those who took at least one dose of vaccine. None of the participants hadn't been reached by at least one of our methods, but 4.7% of those vaccinated did not attribute their vaccine decision to any of our methods. The method with the most attributable vaccinations was the workstation visit (Figure 2).

Table 3. Impact of intervention on vaccination uptake.

Vaccine uptake	Intervention group n = 224			Control group n = 265			p^* Value
	Baseline % (95% CI)	End of study % (95% CI)	p Value	Baseline % (95% CI)	End of study% (95% CI)	p Value	
≥ 1 dose	35.27 (29.02 - 41.91)	75.89 (69.75 - 81.34)	<0.001	25.66 (20.51 - 31.36)	34.72 (29.00 - 40.78)	0.020	<0.001
≥ 3 dose	17.86 (13.07 - 23.51)	65.63 (59.01 - 71.82)	<0.001	8.68 (5.58 - 12.74)	27.92 (22.61 - 33.74)	<0.001	<0.001

p^* is the p value for the difference in the increase between the intervention and control groups

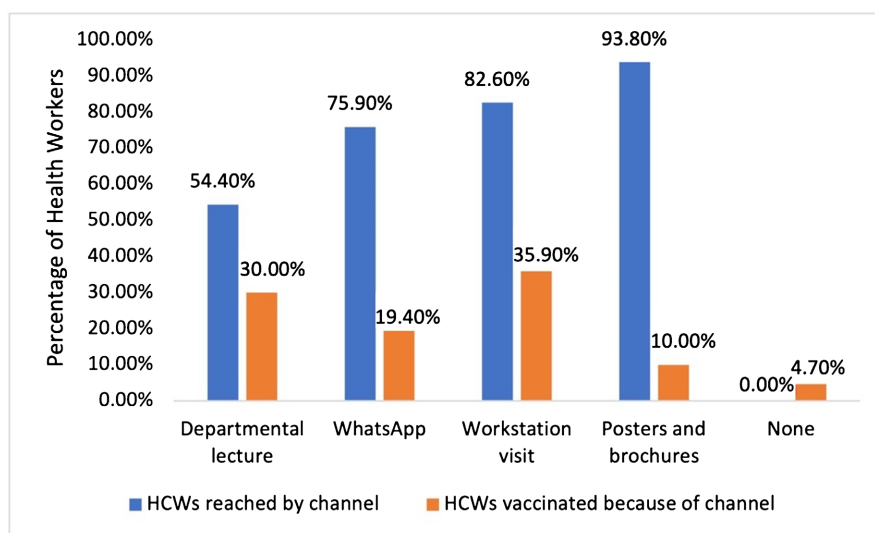


Figure 2. Impact of different methods used in the intervention.

4. Discussion

To the best of our knowledge, this is the largest study on hepatitis B vaccination uptake among HCWs done in Cameroon or Sub-Saharan Africa. The study stands out as it shows evidence of a practical intervention to address the issue of low hepatitis B vaccination uptake among HCWs in LMICs. We have previously reported low vaccination uptake and some predictors of hepatitis B vaccination uptake among HCWs in Fako Division based on our baseline survey for this study [15].

Although most healthcare workers have good knowledge about hepatitis B according to different studies [13] [14] [15], a good number of them are not conscious of the high risk they face of contracting this infection as they carry out their duties daily. The most frequently identified barrier to vaccination uptake in our study was this lack of awareness. Studies have reported low sensitization of different categories of HCWs and trainees to the need for hepatitis B vaccination by the hospital administration or training institution [12] [13]. A study among HCWs has shown that higher awareness of hepatitis B was significantly associated with higher intention to vaccinate [27]. Our intervention modified this factor through the BCC program that educated HCWs to raise awareness and change their behaviour.

The next most cited reason for not being vaccinated was lack of finances. The association between cost and low uptake of hepatitis B vaccine among HCWs is well documented in the literature [13] [28] [29]. Average cost per dose for the hepatitis B vaccine in the study hospital pharmacies was 5000XAF, approximately \$ 10. Many HCWs who are poorly paid find this to be too costly and even expect their employers to administer vaccines to them at no cost. Hospital policies that subsidize or provide long-term payment schemes for HCWs should be adopted by hospitals to improve vaccination uptake. We earlier reported that hospitals with some policies on hepatitis B vaccination coverage for workers, which sometimes included subsidized costs, had significantly higher vaccination uptake than those that had no such policy [15]. Our intervention did not modify this factor and other studies may look at the impact of cost incentives on hepatitis B vaccination uptake among HCWs.

HCWs also complained about the unavailability of vaccine stock at their hospital pharmacies. Most hospitals in the study only stocked hepatitis B vaccines through the expanded Program on immunization (EPI), which only covers children under 5 years of age. Adults seeking hepatitis B vaccination are usually sent to purchase from pharmacies out of hospital and this is a discouraging factor for most HCWs who run very busy schedules. Other studies have reported the lack of vaccine stock at hospital pharmacies as a reason for low uptake among HCWs [28] [29]. Our intervention modified this factor by working with hospital pharmacies in the intervention group to ensure a steady stock of hepatitis B vaccines.

Only 9% of HCWs cited lack of trust in the vaccines as a reason for not taking them. Vaccine hesitancy, although not a strong phenomenon yet among HCWs

in our study hospitals must be properly addressed, especially with the rise of COVID-19 and skepticism about the vaccine among HCWs. Perceived complications and side effects from hepatitis B vaccination have been strongly associated with low vaccination uptake among HCWs [28]. Our intervention addressed this factor through the BCC messages that debunked myths and shared testimonials of several HCWs who had taken the vaccine with little or no complications.

Lastly, negligence was cited by 5% of participants as the reason for not taking the vaccine. Despite knowing all about the disease and the availability of a vaccine against it, many HCWs still do nothing about getting vaccinated due to negligence stemming from a low visibility of hepatitis B in health communication and public health programming. Other studies in Cameroon and elsewhere have reported the role of negligence in the low uptake of hepatitis B among HCWs [16] [29].

As expected participants' responses to knowledge questions on hepatitis B significantly increased for the intervention group, while no significant change occurred for the control group. BCC takes into account contextual lapses in motivation for the practice of a particular behaviour and thus tends to be more effective than simple education. While our goal was not just to increase knowledge but rather vaccination uptake, the increased knowledge of participants in the intervention group affirms that the intervention was effectively carried out. Knowledge performance also increased in the control group although not significant, and we think this is due to the elaborate nature of our baseline questionnaire that must have provoked many in the control group to carry out their own research to know more about the disease.

Vaccination uptake significantly increased in both our intervention and control groups for both ≥ 1 dose and the ≥ 3 dose uptake measurements. We randomized study hospitals such that intervention and control groups should be found in different health districts to avoid intervention spill-over from the intervention group to the control group. However, this was not perfectly achieved as health workers in the intervention sometimes communicated with colleagues in other hospitals to sensitize them to the things they were learning throughout the intervention. The joint effect of this spill-over and the interest raised in all hospitals after our baseline survey is most probably accountable for the increased vaccination uptake among the control participants. However, following our difference-in-difference analysis, there was a very significant higher change in the intervention arm over the control arm. Our mixed intervention of using brochures, posters, WhatsApp, workstation discussions, and departmental meeting lectures proved to be very effective in engaging HCWs into discussions about their high risk for contracting hepatitis B and eventually led to increased vaccination uptake. Educational interventions have been used to improve various health outcomes with different success rates [23] [24] [25]. Traditional educational methods, however, have had mixed reports with some studies reporting a

significant impact in increasing vaccination knowledge among HCWs [19], but other studies report no significant impact on vaccination uptake [20]. Generally, active participatory methods as opposed to passive methods have yielded better results [18]. Our use of information from our findings at baseline and the use of the modified Delphi technique to further make the communication relevant to the audience cannot be over credited for the results achieved.

Even though research assistants mediated some of the communication, the methods used can be easily implemented by hospitals without the need for any additional staff. Hospitals may train focal persons on hepatitis B who coordinate BCC efforts within hospitals for improved hepatitis vaccine uptake. Our intervention raised the uptake of a complete vaccine regimen of 3 doses by 38% in just 6 months and we believe that if sustained and combined with other cost incentives, it could bring the uptake close to 100% seeing that our study recorded very low vaccine hesitancy among the participants.

All participants were reached by at least one of our BCC channels used in the intervention. Of all our methods, the most wide-reaching method was posters and brochures, with around 94% of participants acknowledging having come across one. Posters and brochures can reach a very wide audience and raise general awareness but may not be engaging enough to produce a behaviour change as has been demonstrated among adolescents in Moldova [30]. This is seen in our results as only 10% of participants said they had taken the vaccine because of information obtained from a poster or brochure. From our feedback during the BCC content development, HCWs had complained about not having the time to go through brochures or read through posters and so they had recommended that they be used just as reinforcement for other strategies as they have a capacity for wider reach. As already discussed above, these types of traditional, non-participatory methods are usually not as effective for behaviour change.

The most effective of our methods was the workstation visits, reaching 82% of HCWs and accounting 35% of HCWs' motivation to vaccinate. The workstation visit was very informal and targeted very small groups of HCWs as they carried out their duties. The suitable time for visits was usually agreed on between the research assistants and the unit heads to ensure maximum participation in the brief discussion. Although workers who are very engaged at a particular moment may not benefit from it, this method is still very effective, especially if repeated over a period of time. We did not find other studies that used this particular method for the education of HCWs.

The departmental lectures were the second most effective method used in this study. Although only about 54% of HCWs attested to have attended one, 30% of HCWs indicated that they had been vaccinated due to information shared during these meetings. The sessions were interactive and HCWs could share concerns and get clarifications on their doubts. Departmental meetings are unfortunately not very far reaching since workers on duty at strategic departments are expected to be working even during such meetings.

We also used WhatsApp and more than three-quarters of participants were reached through this channel with almost 20% of HCWs attributing their vaccination uptake to messages received on WhatsApp. Social media platforms like WhatsApp have been used to improve the uptake of different health interventions, especially as the proportion of people who use smartphones has greatly increased [31]. This method places a very limited cost for hospital administrators but needs a focal person to be able to generate interest as social media is usually flooded with several different types of messages.

5. Conclusion

In this study BCC was very effective in increasing knowledge about hepatitis B and in increasing the uptake of vaccine to prevent the disease among HCWs. Our study also revealed that participatory educational methods like work station discussions and lectures at departmental meetings are most effective for improving hepatitis B vaccine uptake among HCWs. Hospitals should customize messages to their particular context and should use a combination of methods to effectively increase the uptake of hepatitis B vaccine among their employees.

Data Availability

All data generated and analysed during this study are included in this manuscript. Data will be provided upon request from the corresponding author.

Acknowledgments

The authors acknowledge the support of the healthcare personnel from all participating hospitals.

Authors' Contributions

SPC participated in the drafting and revising of the manuscript for academic content. SN and ACM conceived the study, participated in data collection, analysis, and interpretation, and drafted the manuscript. NT and EM participated in the design and revised the manuscript.

Funding

This work was carried out with personal funds from the principal investigator.

Conflicts of Interest

The authors declare no conflicts of interest.

References

- [1] World Health Organization (2017) Global Hepatitis Report 2017. Geneva.
- [2] André, F. (2000) Hepatitis B Epidemiology in Asia, the Middle East and Africa. *Vaccine*, **18**, S20-S22. [https://doi.org/10.1016/S0264-410X\(99\)00456-9](https://doi.org/10.1016/S0264-410X(99)00456-9)
- [3] Schweitzer, A., Horn, J., Mikolajczyk, R.T., *et al.* (2015) Estimations of Worldwide

- Prevalence of Chronic Hepatitis B Virus Infection: A Systematic Review of Data Published between 1965 and 2013. *The Lancet*, **386**, 1546-1555.
[https://doi.org/10.1016/S0140-6736\(15\)61412-X](https://doi.org/10.1016/S0140-6736(15)61412-X)
- [4] Mast, E.E., Weinbaum, C.M., Fiore, A.E., *et al.* (2006) A Comprehensive Immunization Strategy to Eliminate Transmission of Hepatitis B Virus Infection in the United States: Recommendations of the Advisory Committee on Immunization Practices (ACIP) Part II: Immunization of Adults. *Morbidity and Mortality Weekly Report*, **55**, 1-33.
- [5] Recommendations for Identification and Public Health Management of Persons with Chronic Hepatitis B Virus Infection.
<https://www.cdc.gov/mmwr/preview/mmwrhtml/rr5708a1.htm>
- [6] World Health Organization (2010) World Health Statistics 2010.
<https://books.google.com/books?hl=en&lr=&id=Z69vxfRfFIsC&oi=fnd&pg=PA1&ots=cIINboMB2C&sig=b-Mb98Ie4FVnIZuuFg0xQZXgMrc>
- [7] Hutin, Y., Hauri, A., Chiarello, L., *et al.* (2003) Best Infection Control Practices for Intradermal, Subcutaneous, and Intramuscular Needle Injections. *Bulletin of the World Health Organization*, **81**, 491-500.
- [8] Hilleman, M.R., McAleer, W.J., Buynak, E.B., *et al.* (1983) Quality and Safety of Human Hepatitis B Vaccine. *Developments in Biological Standardization*, **54**, 3-12.
- [9] Purcell, R.H. and Gerin, J.L. (1975) Hepatitis B Subunit Vaccine: A Preliminary Report of Safety and Efficacy Tests in Chimpanzees. *The American Journal of the Medical Sciences*, **270**, 395-399. <https://doi.org/10.1097/00000441-197509000-00024>
- [10] Shepard, C.W., Simard, E.P., Finelli, L., Fiore, A.E. and Bell, B.P. (2006) Hepatitis B Virus Infection: Epidemiology and Vaccination. *Epidemiologic Reviews*, **28**, 112-125.
<https://doi.org/10.1093/epirev/mxj009>
- [11] Prüss-Üstün, A., Rapiti, E. and Hutin, Y. (2005) Estimation of the Global Burden of Disease Attributable to Contaminated Sharps Injuries among Health-Care Workers. *American Journal of Industrial Medicine*, **48**, 482-490.
<https://doi.org/10.1002/ajim.20230>
- [12] Noubiap, J.J.N., Nansseu, J.R.N., Kengne, K.K., *et al.* (2014) Low Hepatitis B Vaccine Uptake among Surgical Residents in Cameroon. *International Archives of Medicine*, **7**, Article No. 11. <https://doi.org/10.1186/1755-7682-7-11>
- [13] Noubiap, J.J.N., Nansseu, J.R.N., Kengne, K.K., *et al.* (2013) Occupational Exposure to Blood, Hepatitis B Vaccine Knowledge and Uptake among Medical Students in Cameroon. *BMC Medical Education*, **13**, Article No. 148.
<https://doi.org/10.1186/1472-6920-13-148>
- [14] Tatsilong, H.O.P., Noubiap, J.J.N., Nansseu, J.R.N., *et al.* (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**, Article No. 706. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4973072/>
<https://doi.org/10.1186/s12889-016-3388-z>
- [15] Ngekeng, S., Chichom-Mefire, A., Nde, P.F., *et al.* (2022) Hepatitis B Vaccination Coverage and Its Predictors among Health Workers in Fako Division, South West Region of Cameroon. *Open Access Library Journal*, **9**, e8985.
<https://doi.org/10.4236/oalib.1108985>
- [16] Kesieme, E.B., Uwakwe, K., Irekpita, E., *et al.* (2011) Knowledge of Hepatitis B Vaccine among Operating Room Personnel in Nigeria and Their Vaccination Status. *Hepatitis Research and Treatment*, **2011**, Article ID: 157089.
<https://doi.org/10.1155/2011/157089>

- [17] Othman, S., Saleh, A. and Shabila, N. (2013) Knowledge about Hepatitis B Infection among Medical Students in Erbil City, Iraq. *European Scientific Journal*, **3**, 299-305.
- [18] Siriwardena, A.N. (2003) The Impact of Educational Interventions on Influenza and Pneumococcal Vaccination Rates in Primary Care. A Dissertation Submitted in Partial Fulfilment of the Requirements for the Degree of Doctor of Philosophy, De Montfort University, Leicester.
- [19] Zimmerman, R.K., Barker, W.H., Strikas, R.A., *et al.* (1997) Developing Curricula to Promote Preventive Medicine Skills. The Teaching Immunization for Medical Education (TIME) Project. TIME Development Committee. *JAMA*, **278**, 705-711. <https://doi.org/10.1001/jama.278.9.705>
- [20] Briss, P.A., Rodewald, L.E., Hinman, A.R., *et al.* (2014) Reviews of Evidence Regarding Interventions to Improve Vaccination Uptake in Children, Adolescents Adults. The Task Force on Community Preventive Services. *American Journal of Preventive Medicine*, **18**, 97-140.
- [21] National Collaborating Centre for Methods and Tools (NCCMT) (2007) Developing Health Communication Campaigns. <https://www.nccmt.ca>
- [22] National Health Mission India. (2020) Behaviour Change Communication (BCC). <https://arogyakeralam.gov.in/2020/03/27/behaviour-change-communication-bcc/>
- [23] Ntshebe, O., Pitso, J.M.N. and Segobye, A.K. (2006) The Use of Culturally Themed HIV Messages and Their Implications for Future Behaviour Change Communication Campaigns: The Case of Botswana. *Journal of Social Aspects of HIV/AIDS*, **3**, 466-476. <https://doi.org/10.1080/17290376.2006.9724873>
- [24] Hazra, A., Atmavilas, Y., Hay, K., *et al.* (2020) Effects of Health Behaviour Change Intervention through Women's Self-Help Groups on Maternal and Newborn Health Practices and Related Inequalities in Rural India: A Quasi-Experimental Study. *eClinicalMedicine*, **18**, Article ID: 100198. <https://doi.org/10.1016/j.eclinm.2019.10.011>
- [25] Hoddinott, J., Ahmed, A., Karachiwalla, N.I. and Roy, S. (2018) Nutrition Behaviour Change Communication Causes Sustained Effects on IYCN Knowledge in Two Cluster-Randomized Trials in Bangladesh. *Maternal & Child Nutrition*, **14**, e12498. <https://doi.org/10.1111/mcn.12498>
- [26] De Meyrick, J. (2003) The Delphi Method and Health Research. *Health Education*, **103**, 7-16. <https://doi.org/10.1108/09654280310459112>
- [27] Herzog, R., Álvarez-Pasquin, M.J., Diaz, C., *et al.* (2013) Are Healthcare Workers' Intentions to Vaccinate Related to Their Knowledge, Beliefs and Attitudes? A Systematic Review. *BMC Public Health*, **13**, Article No. 154. <https://doi.org/10.1186/1471-2458-13-154>
- [28] Hamissi, J., Tabari, Z.A., Najafi, K., Hamissi, H. and Hamissi, Z. (2014) Knowledge, Attitudes and Practice of Hepatitis B Vaccination among Iranian Dentists. *International Journal of Collaborative Research on Internal Medicine & Public Health*, **6**, 199-206.
- [29] Feleke, B.E. (2016) Low Uptake of Hepatitis B Vaccine and Determinants among Health Professionals Working in Amhara Regional State Hospitals, Ethiopia. *Journal of Public Health in Africa*, **7**, Article No. 553. <https://doi.org/10.4081/jphia.2016.553>
- [30] Hasanica, N., Ramic-Catak, A., Mujezinovic, A., *et al.* (2020) The Effectiveness of Leaflets and Posters as a Health Education Method. *Materia Socio Medica*, **32**, 135-139. <https://doi.org/10.5455/msm.2020.32.135-139>
- [31] Yusriani, Y. and Acob, J.R. (2020) Effect of Education through Whatsapp Media in

Changing of Smoking Behavior among Senior High School Students. *Kesmas: National Public Health Journal*, **15**, 134-141.

<https://doi.org/10.21109/kesmas.v15i3.3270>

Abbreviations

HCW	Health Care Workers
HBV	Hepatitis B Virus
BCC	Behaviour Change Communication
LMIC	Low and Middle Income Countries
EPI	Expanded Program on Immunization