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Protecting health workers from nosocomial Hepatitis B infections: a review of strategies and challenges to implementation of Hepatitis B vaccination among health workers in Sub Saharan Africa

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2006

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Abstract

Protecting health workers from nosocomial Hepatitis B infections: a review of strategies and challenges to implementation of Hepatitis B vaccination among health workers in Sub Saharan Africa

By Bridget Malewezi

Background: The Sub Saharan region has the highest Hepatitis B virus (HBV) rates and health workers are at increased risk of contracting nosocomial HBV infection. Vaccination of health workers plays a critical role in protecting them from sequelae of HBV. However health worker vaccination remains a challenge for many countries.

Aims: To review practices/measures and challenges in the Sub Saharan region relating to vaccination of health workers against HBV.

Methods: Literature review of articles which addressed any aspect of HBV vaccine in health workers in the sub-Saharan region sourced from PubMed, Embase and Web of Science. Data extracted in Excel and analyzed in SAS 9.4. Case study of Malawi policies and strategies in training institutions and facilities.

Results: Awareness of HBV and vaccine was relatively high, but vaccination rates were lower with 4.6% to 64.4% of those 'ever vaccinated' completing vaccination regimen. There was also great variation in proportion of health workers who had natural immunity from previous exposure (anti HBC) range 41% to 92%. Commonly cited reasons for non-uptake of vaccine included cost, lack of awareness of vaccine availability and inadequate information on vaccine.

Conclusion: Countries in the region will require locally relevant data to develop cost effective strategies that maximize the benefit to their health workers due to the great diversity of HBV epidemiology in the region.

Key words: "Hepatitis B", "Hepatitis B vaccine"; "Health worker"; "Africa"

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Chapter 1: Introduction

Health workers are at increased risk of contracting Hepatitis B virus (HBV) in the workplace due to their potential contact with infected bodily fluids such as blood, saliva or vaginal fluids [1]. Worldwide, HBV is estimated to have infected over 2 billion people and causes 0.5M deaths annually [2]. Mortality is mainly due to sequelae of chronic infection such as liver cirrhosis and liver cancer. Prevalence of HBV infection amongst health workers depends on the rates of HBV in the region where they work, but studies have shown rates between 0.8% and 74.4% [3-5]. WHO has recommended that high risk groups such as health workers should be targeted for routine provision of HBV vaccine to protect them from this infection. Despite the fact that health workers are an accessible and easily identifiable population to implement vaccination strategies, many countries (including those in the West) face challenges in addressing at risk target groups [6, 7] and 24% of the health workforce worldwide are not vaccinated against HBV [8].

The Sub Saharan region has the highest HBV rates ranging from 5 – 8% [9-11] and co-infection with HIV is high with 15% of people living with HIV also infected with HBV [2, 12-15]. The region is also faces critical shortages of health workers, and despite shouldering 24% of the global disease burden, it has only 3% of the global health workforce [16]. Morbidity and mortality related to chronic diseases such as HIV [17, 18] and potentially HBV contribute to high attrition amongst health workers.

While many of these countries have implemented universal HBV vaccination for infants [19], there is limited visibility on what is happening related to protecting health workers from an infection that can be easily prevented with a 3 dose regimen of HBV vaccine.

This review will provide an initial insight into practices/measures currently in place in the sub Saharan region addressing vaccination of health workers against HBV. We will also highlight any key challenges and gaps that are pertinent in this region in the hope that this information can help guide implementing governments protect health workers from a preventable cause of significant morbidity and mortality.

Chapter 2: Background and Literature Review

Background

Hepatitis B is a viral infection that causes inflammation of the liver. There are 5 types of viral hepatitis (A-E) however they are all distinct in morphology, transmission and epidemiology. Hepatitis B virus (HBV) is an enveloped virus containing double stranded DNA and is part of the Hepdnaviridae family of viruses which cause hepatitis in a narrow range of species [20]. Humans are the natural reservoir for HBV. The virus was initially discovered by Dr. Baruch Blumberg in collaboration with other scientists from Japan and USA during multi country studies on immune responses to antigens in 1965 [21].

Transmission

Transmission of HBV is via four recognized modes – mother to child (perinatal); contact with an infected person (horizontal); sexual and parenteral. Although antigens of HBV can be detected in all bodily fluids and secretions only blood, vaginal/menstrual fluids and semen are infectious [20, 22]. HBV can remain infectious on surfaces like eating utensils, razors and hospital equipment for up to 7 days. Following infection, HBV attaches to receptors of hepatocytes and replicates inside the cell nucleus using the host cell mechanisms. The incubation period for HBV is between 6 – 24 weeks, following which patients can develop either acute or chronic infection [23, 24]. Acute episodes can be characterized by nausea, jaundice and malaise which may either resolve or progress to fulminant infection. The majority of infected individuals do not develop any symptoms during acute HBV episode and are often unaware of their infection. Only 1% of cases lead to fulminant hepatitis B. Most adults recover from infection with only about 5 - 10% progressing to either become asymptomatic carriers or develop chronic infection. However 90% of infected infants develop chronic carriage. Approximately 20% of those with chronic persistent infection develop liver cirrhosis, which can eventually lead to hepatic carcinoma[24].

Immunology

HBV has several antigenic particles most notably Hep B Surface antigen (HepBsAg), Hep B core antigen (HepBcAg) and Hep B e antigen (HepBeAg). These circulate in blood and can be present in other bodily fluids following infection and at different stages of the disease. Diagnosis of HBV is based on detection of these antigens as well as titers of the antibodies to them (i.e. anti HBs, anti HBc & anti HBe) in serum. Not all these are present at the same time and thus allow for differentiation of acute, chronic or past infection. Other tests for whole virus particles, viral DNA or RNA and other antigens isolated from either blood or liver biopsies are available but their use is limited to research settings. Quantification of Hep B DNA however, has been utilized to determine infectivity of patients diagnosed with chronic hepatitis B infection[20].

Treatment

There is no treatment for acute Hepatitis B, however where indicated supportive treatment of symptoms can be given especially in fulminant disease. For those with chronic disease main aims of treatment are to reduce infectivity (thus reduce transmission to others), prevent progression of liver disease and development of hepatocellular carcinoma. Two main classes of treatment are available – antivirals which suppress HBV (e.g. lamivudine, famciclovir) and immune modulators which assist the body mount an immune response to the infection[20]. Interferons which have both antiviral and immunomodulatory properties have been used widely in the management of chronic HBV infection.

Epidemiology

Hepatitis B (HBV) is one of the most serious and pertinent of the 5 types of viral hepatitis, with 2 billion people previously infected and causing approximately 500 000 deaths annually [2]. HBV causes 4 million infections annually and approximately 350 million individuals are chronic carriers [9, 25]. Sub-Saharan Africa (also referred to as WHO AFRO region) comprises of 46 countries with an estimated population of 857 million [2]. The burden of viral hepatitis, though not accurately known, is believed to be one of the highest in the world [2] along with a high burden of HIV. The

prevalence of HBV is estimated at 8% in West Africa and 5%–7% in central, eastern and southern Africa [9-11]. Co infection with HIV also is a risk factor for poor outcomes, with research from 20 sub-Saharan African countries estimating prevalence rate of HBV of 15% among people living with HIV [2, 12-15]. Additional risk is posed due to dietary exposure to aflatoxins commonly found in diets in this region, studies have shown multiplicative interaction between HBV and aflatoxins in terms of risk of development of hepatocellular carcinoma [26, 27].

Hepatitis B Vaccine

Vaccination is the mainstay of prevention of HBV. Vaccinations have been available on the market since 1982 and currently available in formulations of both monovalent (only targeting HBV) as well as in combination with other vaccines (e.g. DTP-polio, MMR)[20, 28]. HBV vaccines contain inactivated HepBsAg derived either from plasma derived or recombinant DNA. When administered appropriately vaccines confer protection in 95% of recipients, and could prevent between 80-95% of HBV associated deaths [20]. Vaccines are provided via intramuscular injection either on the thigh or deltoid muscle, however intradermal vaccination has been shown to be effective for intramuscular vaccination non-responders [29]. Immune response to the vaccine results in elevation of titers of anti HBs, initial levels post vaccination of above 10 IU/l are considered protective [28]. Vaccines must be stored in cold chain between 2 – 8°C and lose immunogenicity when frozen, however they are relatively stable with exposure to high temperatures. Some patient factors are also associated with reduced immunogenicity such as tobacco smoking, immunosuppression and old age (4). Duration of protection of vaccines is long term with 1 study of Alaskan natives elucidating protection for at least 22 years in vaccine responders [30]. However several studies have shown waning immunity with Anti HBs levels declining over time, but booster dosage is not required following completion of the initial vaccine regime [28, 31] unless post immunization tests indicate insufficient immune response (most notably in health workers). Those who had previously responded to initial vaccine regimen continue to be protected even with low anti HBs levels and show an anamnestic response to exposure [30, 32, 33].

Vaccines can be given perinataly, in infancy, to high risk groups (such as injecting drug users; health care workers [34, 35] or to immunosuppressed individuals. The dose schedule and amount provided depends on the targeted population but often comprises of 3 doses of vaccine within a 6 month period. HBV vaccines have a good safety profile, producing minor local reactions such as soreness which resolve within 2-3 days. Rarely patients may develop allergic reactions to vaccine components e.g. yeast. Vaccination of carriers has no therapeutic effect and does not produce any adverse effects[28]. Due to the high conversion of infants to chronic infection/asymptomatic carriage, universal vaccination of infants is the primary strategy for HBV prevention. However this does not preclude vaccination of high risk groups or utilization of other prevention strategies. Other measures to prevent HBV include screening of blood donated for transfusion, use of Hep B immunoglobulin (HBIG), universal precautions such as use of gloves when in contact with blood products and disinfection of equipment by autoclaving and use of disinfecting agents.

Prevention

In 1991 WHO recommended that all countries (regardless of prevalence rates) introduce Hepatitis B vaccines in national immunization programs[36]. There has been wide-scale implementation of universal childhood vaccination for hepatitis B with 180 countries including HBV vaccination in their routine vaccine schedules as of 2011 [2], this intervention alone has prevented approximately 1 307 000 deaths[19]. However targeted vaccination of at risk groups have had limited success due to difficulties in identification of target population and implementation strategies [2]. The availability and use of HBV vaccine, as well as standing orders to routinely offer the vaccine would remove many of the barriers to protecting at-risk populations from HBV infection. While transmission from health worker to patients is rare, workplace injuries such as needle stick injuries with infected sharp instruments are common and a large proportion of health workers have had at least one needle stick injury in their career. Despite the potential risks, 24% of health workers worldwide are not vaccinated against HBV [8].

Problem statement and Rationale

Currently there is limited visibility into current practices relating to hepatitis in Africa region. Only 12 out of 47 countries provided data in a WHO global baseline survey. This may be attributable to the lack of any clear national focal point or department leading viral hepatitis prevention and control efforts[2]. Many countries lack standard guidelines and policy on HBV and viral hepatitis overall to guide decision making and resource mobilization – the lack of data highlighted above has made it additionally difficult to make evidence based country specific policies related to viral hepatitis. While some studies have been done in the region on sero-prevalence, lack of insight into their own burden at country level makes it difficult. Many countries have some level of hepatitis interventions e.g. immunization of newborns and universal infection prevention measures in hospitals– how to address key populations at risk remains a challenge e.g. vaccination of health workers [2, 25].

Chapter 3: Manuscript

Title Cover Page

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Student Contribution

For this manuscript I developed the initial concept for the study which was then subsequently expanded following advice from my thesis advisor. I conducted the literature review, data collection for the case study and data analysis. I drafted all sections of the manuscript with revisions made following editorial feedback from my thesis advisor and co-authors.

Abstract

Background: The Sub Saharan region has the highest Hepatitis B virus (HBV) rates and health workers are at increased risk of contracting nosocomial HBV infection. Vaccination of health workers plays a critical role in protecting them from sequelae of HBV. However health worker vaccination remains a challenge for many countries.

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Introduction

Health workers are at increased risk of contracting Hepatitis B virus (HBV) in the workplace due to their potential contact with infected bodily fluids such as blood, saliva or vaginal fluids [1]. Worldwide, HBV is estimated to have infected over 2 billion people and causes 0.5M deaths annually [2]. Mortality is mainly due to sequelae of chronic infection such as liver cirrhosis and liver cancer. Prevalence of HBV infection amongst health workers depends on the rates of HBV in the region where they work, but studies have shown rates between 0.8% and 74.4% [3-5]. WHO has recommended that high risk groups such as health workers should be targeted for routine provision of HBV vaccine to protect them from this infection. Despite the fact that health workers are an accessible and easily identifiable population to implement vaccination strategies, many countries (including those in the West) face challenges in addressing at risk target groups [6, 7] and 24% of the health workforce worldwide are not vaccinated against HBV [8].

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This review will provide an initial insight into practices/measures currently in place in the sub Saharan region addressing vaccination of health workers against HBV. We will also highlight any

key challenges and gaps that are pertinent in this region in the hope that this information can help guide implementing governments protect health workers from a preventable cause of significant morbidity and mortality.

Methods

A literature search was conducted in PubMed, Web of Science & Embase using MESH terms. Studies which addressed aspects of HBV vaccine in health workers in the sub-Saharan region were identified. Exclusion criteria were – studies conducted in other regions not from Sub Saharan region including the 5 countries in Africa that are not considered sub-Saharan (i.e. Algeria, Egypt, Libya, Morocco & Tunisia) & duration > 15 years (i.e. earlier than 2000). All study types were eligible for inclusion in the review. A total of 41 studies were identified of which 33 had full text available [7, 20-51]. HBV specific data was extracted in Excel and analyzed in SAS 9.4.

Due to the wide variability of definitions/measures of knowledge in the studies reviewed – for the purpose of this study, '*awareness of HBV'* was defined as proportion of respondents that 'knew of HBV as a potential occupational risk' and *'awareness of HBV vaccine'* was defined as proportion of respondents 'who knew of the existence of HBV vaccine'. Other aspects of knowledge e.g. transmission, vaccine characteristics/dosing and categorization of good vs. poor knowledge were inconsistently reported thus were not extracted for review. Vaccination status was defined on two levels – *'ever vaccinated'* i.e. proportion of respondents who had received at least 1 dose of vaccine. *Complete vaccination* was defined as receipt of all 3 doses (regardless of whether they had post vaccination immune testing or not).

For more in-depth focus –Malawi, a country in the southeastern region of the continent was used as a case study country. Policies addressing various aspects of the health sector were reviewed as well as email questionnaire of sampled health worker training institutions and districts. 4 training

institutions were sampled to provide information on vaccination of student health workers and 3 provided responses. 3 districts out of 28 were sampled and 2 provided responses.

Results

The 33 studies represented 14 out of the 47 SSA countries, most of which were conducted in Nigeria (n=13). The majority of the studies were cross sectional focusing mainly on vaccination status (n=29) amongst doctors and nurses, but some also included other cadres such as paramedical, support staff and students **(Table 1)**.

Awareness & Vaccination Rates

Generally awareness of HBV as an occupational risk and existence of HBV vaccine was relatively high amongst health workers –with HBV awareness ranging between 52.0% [20] to 98.3% [24], vaccine awareness between 70.2% [21] to 98% [38]. However vaccination rates were lower – with 'ever vaccinated' rates ranging from between 0% amongst medical waste handlers in Ethiopia [45] to 91.9% in a study where a hospital in Nigeria introduced an HBV vaccination campaign for all staff [34]. Despite this wide range the majority of studies found rates within the 40% - 60% mark **(Figure 1).** Completion of all 3 doses was much lower ranging between 4.6% [7] – 64.4 % [48] and post vaccination immune testing ranging between 0% [20, 46, 48] -12.7 % [36] **(Table 2).**

HBV Immunology

Seven studies assessed laboratory based markers of HBV [7, 27-29, 42, 43, 48]. There was great variability in the immunological status of health workers, with the range of anti HBC (indicating natural immunity from exposure to HBV infection) ranging from 41% in Kenya [48] to 92% in Niger [43]. Acute infection and chronic carriage as determined by detection of HBsAg ranged between 4% [48] - 25.7% [27] **(Table 2).**

Strategies & Challenges

Only 2 studies reported on mandatory vaccination - a subset of nurses in Tshwane metro region [30] and some training institutions [35] in South Africa but did not do comparison of vaccination rates between the mandatory vs voluntary participants. Vaccines were provided free of charge in most settings but where health workers had to pay for vaccination – cost was often provided as a reason for non-uptake. Lack of awareness of availability of vaccine in institution/country, lack of time and inadequate information on vaccine were other commonly cited reasons. While HBV vaccination was generally acceptable in most of the studies, some health workers did not see its importance and others feared side effects of the vaccine.

Only 2 studies specifically targeted improving uptake of HBV vaccine – 1 based in a hospital in Nigeria [34] and the other for a district in Kenya [48]. Both utilized increased awareness/education on HBV and then vaccines provided free on a voluntary basis with 'ever vaccination' rates of 91.9% and 81.8% and completion rates of 50.3% and 64.4% achieved respectively. The Kenya study utilized pre-vaccination testing of anti HBC to determine eligibility for vaccination.

A key gap identified in several studies was the lack of comprehensive strategies for targeting health workers thus resulting in inconsistent policies and implementation, lack of treatment options for infected health workers and overall poor uptake of vaccine.

Malawi Case study

There is no specific policy and no dedicated department overseeing issues of hepatitis in the country. The current 5 year strategic plan guiding prioritization of all activities in the health sector [52] does not mention hepatitis for health workers or the society overall. While HBV vaccine is universally provided to infants in a combination vaccine (Pentavalent) since 2002 with coverage rates above 95% annually [53], the immunization program does not provide HBV vaccine to health workers.

Of the 9 policies and acts that address health worker welfare, 2 of them mentioned HBV vaccine – mainly mandating 'employers' to provide the vaccine to newly recruited staff, and to train health workers on risks **(Table 3)**. While government is the major employer of health workers in the country, due to the decentralized system, this mandate falls on individual districts to decide when and how vaccination will be provided. The regulatory authorities have no explicit mandate to follow up if this is done and their major tracking is to ensure training institutions include training of nosocomial infections in their curricula.

The sampled training institutions for health workers did not have written policies on HBV vaccination but do provide mandatory HBV vaccine to students prior to clinical attachment. The government schools provided vaccination free of charge while Mulanje Mission included payment for vaccine in fees. All do not conduct pre or post testing on immune status **(Table 4).**

While the Infection Prevention policy indicates importance of HBV vaccination for 'healthcare personnel' it is unclear whether this extends to cleaners and other staff working in the hospital environment. As shown in the case of the sample districts the policy is interpreted differently at ground level **(Table 4)** and in some districts is not extended beyond the district hospital setting to smaller facilities.

Discussion

Our findings show that while awareness of HBV and vaccine is high among health workers, uptake of the vaccine remains suboptimal in most countries in the region. A study in Pakistan identified a similar pattern [54], however others identified poor knowledge in health workers [55-57] as a key barrier to uptake. A possible explanation for this might be that since our study only explored 'awareness' and not all aspects of knowledge there might still be gaps in knowledge in other areas e.g. transmission modes, vaccine characteristics etc. Six of the 10 studies that explored reasons for

non-uptake of vaccine cited ‘inadequate information on vaccine’ as a factor thus suggesting that knowledge amongst health workers may not be comprehensive.

While there seems to be increasing attempts by countries to align to WHO recommendations to make the vaccine available to health workers, our findings highlight the unique and often complex challenges that the region faces in making this a reality.

Vaccination of health workers in endemic settings

The primary challenge of whether it is necessary to provide the vaccine at all in highly endemic settings where potentially the majority of health workers may be already exposed is a critical one that countries need to address. Studies from Niger and Cameroon found natural immunity rates (anti HBC) over 90% [28, 43] and thus few health workers needing vaccination. However the diversity in HBV endemicity in the region as shown by the wide range of 41% in Kenya [48] to 92% in Niger [43] means that ideally each country would require to base their vaccination policy on its local levels of HBV endemicity amongst health workers.

According to WHO estimates for the general adult population, countries in the north and western part of the region (includes Cameroon and Niger) are high endemicity countries, the rest of the region is categorized as high intermediate [19]. In USA and 6 European countries health worker vaccination is universally provided without prior testing due to their low HBV endemicity [58, 59] except in special cases. This means that while universal vaccination of health workers (without prior immune testing) can be implemented in intermediate endemicity countries in the region (since they will have higher proportions of susceptible health workers), targeted vaccination after immune testing may be an option for high endemicity countries. While the studies above showed it is possible to conduct pre-vaccination screening in a hospital/district setting, the logistical challenges and financial implications may limit its feasibility on a national scale. Additionally

with the increasing uptake of infant immunization in the region, there may be need to continually review the strategies of addressing health worker immunization as endemicity levels change[31].

Categorization of which health workers should receive vaccine

The next challenge is which 'health workers' require vaccination. While majority of studies focused on doctors and nurses, others showed that other cadres' e.g. medical waste handlers, mortuary workers, support staff are also susceptible to HBV in the region [23, 36, 40, 45] and could potentially benefit from vaccination. As shown in the Malawi case study, without explicit guidelines on who exactly should receive the vaccine, some facilities can focus on clinicians and nurses only leaving other workers susceptible. Additionally in the case of Malawi the cadres that districts/facilities target for 'on the job' vaccination could have potentially already received vaccine during their training – although one district highlighted that most staff had not received vaccine before. WHO does not recommend booster doses unless in cases where post vaccination immune testing has shown insufficient immune response[60]. Some settings stratify which health workers are vaccinated by type of work carried out in the hospital. CDC guidelines however make provisions that decision on which additional health workers receive vaccine can be guided by the context of the facility [58] so potentially all workers in a hospital (including administrative staff) can receive vaccine as some study sites did in our findings [34]. Additionally because students are often at higher risk for injuries (due to their inexperience) prioritizing vaccination while undergoing training is a key strategy that can optimize protection of health workers.

Competing priorities

While hepatitis is receiving more attention on a global scale, countries often have competing priorities in the health sector as shown in the case of Malawi where there was little to no mention of HBV in the key documents guiding the sector. Diseases such as HIV, Malaria and TB often have a more prominent focus in the region, and this means that resources for HBV prevention may

be limited. While GAVI has assisted several countries in the region to introduce HBV vaccine (in a combined form as Pentavalent) for infants at a subsidized cost [2] there is no provision for vaccination of health workers. Countries would have to be bear this cost which can prove restrictive especially if this cost is then extended to the health worker themselves.

Challenges in implementation

Apart from cost, the other challenges identified such as lack of awareness of availability of vaccine, poor vaccination completion rates, lack of explicit treatment options for exposed health workers are also pertinent issues that any country in the region developing a policy for HBV vaccination of health workers needs to address. As shown in the 2 studies that aimed at raising uptake of vaccine [34, 48], where deliberate measures are implemented to make the vaccine available and increase awareness/knowledge of vaccine amongst health workers voluntary uptake can be relatively good.

There is often debate as to whether vaccination of health workers should be mandatory or voluntary but both have been shown to be possible in various settings [59] and as shown in the Malawi case study. The voluntary or "opt in" strategy where the institution has the vaccine but it is up to the health worker to request vaccination can raise uptake as shown in the 2 studies above but may have varying results at different healthcare levels [48]. Introduction of policies that mandate or encourage HBV vaccination in the workplace can result in higher vaccination coverage [60]. Mandatory or "opt out" strategies where vaccine is offered to all eligible health workers and those who do not want can opt not to receive, was shown to be successful in increasing flu vaccine coverage in a study in USA [61] The option on which to implement will be guided by the overarching laws and principles that guide freedom of choice/public health etc. in each country.

WHO encourages innovative approaches to HBV vaccination and our findings reiterate that a 'one size fits all' policy cannot work across the region, thus countries will have to develop unique and often targeted strategies to suit their specific country context.

Recommendations

1. While awareness of HBV and vaccine may be high it is not sufficient to drive high uptake of vaccine thus more comprehensive measures to ensure uptake and compliance may need to be incorporated that address other barriers such as cost, availability etc.
2. Where feasible, providing HBV vaccine as part of the default package of provisions for health workers via mandatory/ 'opt out' strategies may be effective in the region.

Study Limitations

While our study attempted to provide an overview of findings related to health worker HBV vaccination in the region, we had a number of limitations. There have been many changes in policies and modalities on HBV vaccination especially following WHO 2010 resolution [62]. Due to the 15 year span utilized in our study, older studies may not be reflective of current trends in the countries. However only 12 of the 33 studies included were before 2010 thus the majority of studies are more recent and likely reflect the status quo of the countries. There was also variability within studies on how some factors were categorized e.g. vaccination status, knowledge etc. During data extraction and cleaning we standardized terminology to categories that were more consistent across the studies. Finally due to our small sample for the Malawi case study – findings from the training institutions and districts may not be reflective of all the facilities thus would probably benefit from a larger study to fully explore practices across the country.

However despite these limitations our study provides a succinct summary on issues related to health worker vaccination for HBV and provides context for further discussion and research on the topic in the region.

Conclusion

Countries in Sub-Saharan region who want to implement HBV vaccination of health workers will need to base their strategies to local epidemiology and guiding principles. Such plans ideally should be guided by locally relevant evidence and experts, and should be comprehensive (not just vaccination but treatment and address factors limiting uptake), and be consistently applied throughout each country.

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Table 1: Characteristics of studies on HBV vaccine in Sub-Saharan African health workers from year 2000 - 2015. (n=33)

A. Countries where studies were conducted	
Nigeria	13
South Africa	5
Cameroon	4
Ethiopia	3
Kenya	2
Togo	1
Burkina Faso	1
Niger	1
Sudan	1
Uganda	1
Combined regional [a]	1
B. Study setting	
Health facility (hospital/clinic)	14
Training institution	4
District level	8
National Level	6
Regional level	1
C. Year of publication	

2000 - 2004	6
2005 -2009	6
2010 - 2015	21
D. Study type	
Cross sectional	29
Cohort	1
Quasi experimental	2
Policy review	1
E. Sample size	
<50	2
50 - 100	8
101 - 500	17
>500	4
F. *Cadres covered	
Single cadre	11
Multiple cadres	22
***Doctors (any specialty)**	24
Nurses	21
Dentists	16

***Paramedical (lab/auxiliaries/clinical officers)**	19
***Support staff (cleaners/waste handlers/**	11
***Administrative staff (no contact with patients or materials - accounts etc.)**	6
***Students (medical/nursing/dentist)**	10
G. Aspect of HBV addressed	
Awareness of HBV & vaccine	9
HBV vaccination status	29
HBV Lab based markers	7
Other[b]	10

[a]*Combined regional = Cameroon, Ethiopia, Ghana, Kenya, Madagascar, Malawi, Mozambique, Nigeria, Rwanda, South Africa, Sudan, Tanzania, Uganda & Zambia.* [b]*Predictors uptake/policy/risk perception/challenges*

Figure 1: Boxplot of 'ever vaccinated' vaccination status of sub -Saharan health workers in studies that provided estimates of vaccination rates (n=29). 2000 – 2015.

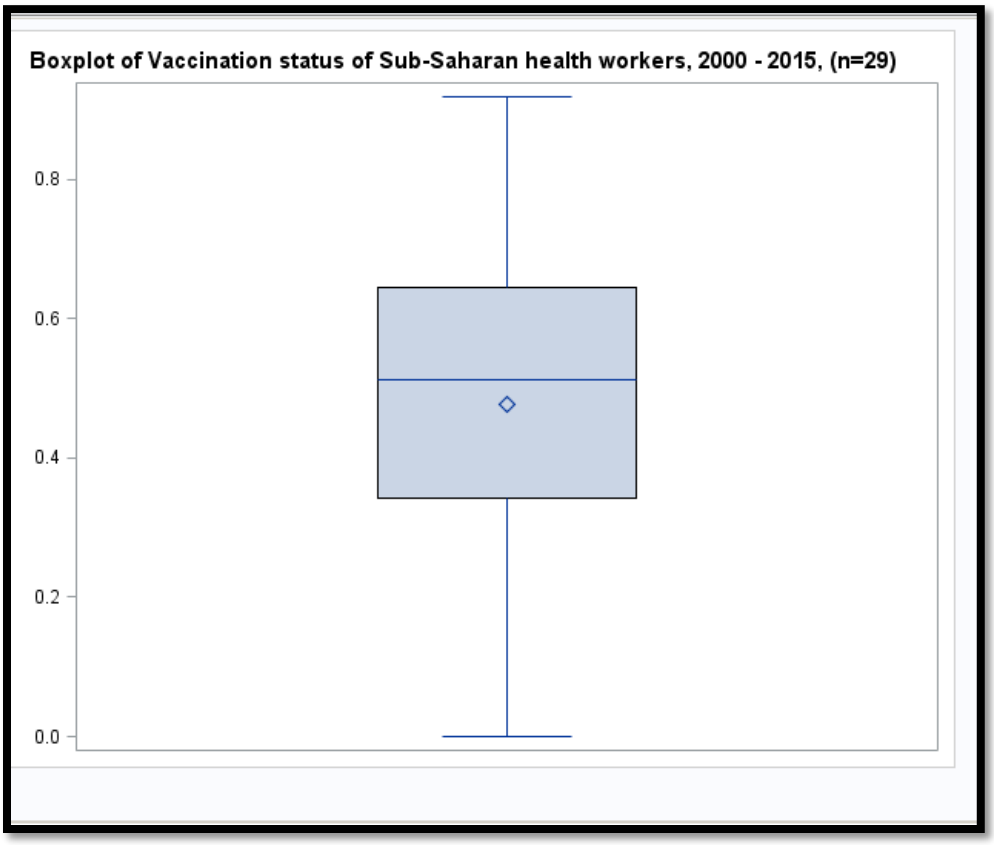

Table 2: Summary key findings of studies on HBV vaccine in Sub-Saharan African health workers from year 2000 - 2015. (n=33)

Variable	Lowest value	Highest value	No of studies
Awareness of HBV	52.0%	98.3%	8
Awareness of HBV vaccine	70.2%	98.0%	5
Vaccination status (ever vaccinated)	0.0%	91.9%	29
Vaccination status (complete vaccination)	4.6%	64.4%	18
Vaccination status (immune testing)	0.0%	12.7%	8
Lab based markers overall	60.1%	76.6%	2
HBsAg	4.0%	25.7%	6
Anti HBS	22.2%	61.6%	3
Anti HBC	41.0%	92.0%	5
Reasons for non-vaccination (n=10)	**No of studies citing reason**		
Cost	8		
Unaware available	7		
Inadequate information	6		
Time	3		
Vaccine not important	3		
Ignorance	2		
No reason	2		
Potential side effects	2		
No policy in place	1		
Low risk perception	1		

Table 3: Key Documents related to the health Sector in Malawi highlighting the provisions made for health workers or HBV.

	No mention of Hepatitis B virus	
A. Guiding Health sector practice		
Document	Year	Provisions
Health Sector Strategic Plan (HSSP)	2011 - 2016	Guide prioritization of diseases and strategies for health sector
Health Promotion Policy	2013	Prioritization of diseases and strategies to promote public health
Public Health Act	1976	Guide actions for diseases of public health concern
B. Guiding health worker welfare		
I. General		
Employment Act	2000	Guiding roles and responsibilities of 'employers' & employees
Workers Compensation Act	1992	Compensation for injuries suffered or diseases contracted by workers in the course of their employment or for death resulting from such injuries or diseases
Occupational Safety Act	1997	Regulation of the conditions of employment in workplaces as regards the safety, health and welfare of staff.
II. Specific to Health workers		
Medical Practitioners Act	1987	Establish Medical Council
Nurses and Midwives Act	2002	Regulate training, discipline, registration and practice of nurses
Code of Ethics for medical Practitioners & Dentists	1990	Code of ethics and practice for medical practitioners
	b. Infant immunization HBV	

Draft EPI Policy	Draft May 2015	Focus on infants under one
Comprehensive EPI Multi-Year Plan	2012 - 2016	Activities promoting infant immunization
National Action Plan on NCDS	2012 - 2016	Promote cancer preventing vaccines e.g. HBV vaccine*(non-specific on strategies e.g. infant vs high risk groups)

	c. HBV vaccination of health workers	
National Care of Carer HIV AIDS Workplace Policy	2005	Health workers should be provided education, resources (e.g. PPE/AD syringes) and information on HBV. Health workers should be vaccinated against HBV. Facilities should train on and provide PEP* (Not specific if PEP only for HIV or includes other nosocomial infections e.g. HBV)
Infection Prevention and Control Policy	2006	Employers' should do health assessment of new staff to include screening for HBV. Employer to provide HBV vaccine. Training institutions to train on infection prevention and include in curricula. Regulatory authorities to follow up if IP included in curricula.

Table 4: Training institution & district practices for HBV vaccination for health workers and students in Malawi.

Training Institution Responses				
	College of Medicine	Mulanje Mission Nursing College	Kamuzu College of Nursing	Malawi College of Health Science
Ownership	Government	Mission	Government	Government
Cadres trained	Doctor (MBBS), Lab Technician (MLT), Physiotherapists, pharmacists	Nurse Midwives (NMT), Community Nurse (CMT)	Nurses	Paramedical - clinical officer/ medical assistant/ lab technicians
Written Policy	No			
Immune testing	No	No	No	
HBV provided	Yes	Yes	Yes since 2008	Yes*
Free or Paying	Free	Students pay - incorporated in fees	Free	
Mandatory or Voluntary	Mandatory	Mandatory	Mandatory * except those who are pregnant	
Years vaccine provided	MLS - Year 1, MBBS & Pharmacy - Year 3	Year 1 (1st 2 doses provided within first 12 weeks of training)	Yr. 1 (before clinicals)	
Years when students start clinical attachment	MLS - Year 1, MBBS & Pharmacy - Year 3	Year 1 (after 1st 12 weeks)	Yr. 1 (2nd semester)	
How are students informed of vaccine	Reminders sent through group emails of the next dose as date approaches.	Informed that will need to receive vaccine in the offer letter for acceptance into the school. Gives fee breakdown. Then when arrive - provided details on HBV and vaccine	All year one students are informed about vaccine as part of their orientation into college.	

Does school track who receives	Yes. Document all students who receive vaccine. There has never been defaulters.	School has a register (track to ensure all students get initial 2 doses before start clinicals) - there are some defaulters (mainly due to fear of side effects/pain but counsel defaulters to complete regimen)	follow up on students completion of vaccination before they go for attachments	
District Responses				
	Neno	**Dedza**		
No of facilities	14 (9 public, 4 mission, 1 private)	34 (23 public, 11 mission)		
Does district provide HBV vaccine	Yes but not routinely due to cost	Yes		
When is it provided	Given 3 years ago	Currently conducting vaccination campaign this year		
Voluntary vs Mandatory	Voluntary	Voluntary		
Cadres who receive	Doctors, Nurses, Clinical Officers & Medical Assistants	Doctors, Nurses, Clinical Officers, Medical Assistants, Health Surveillance Assistants & Support staff - patient attendants etc. (only Admin staff excluded). *observed that most staff (all cadres) had not received vaccine before.		
Provided to all facilities	No just at district hospital	Yes, all public facilities, but starting with district hospital.		
How is it coordinated	HWs made aware of availability of vaccine, self-motivated uptake from pharmacy, no official tracking of completion of doses etc.	Coordinated by office of the District medical officer, HWs made aware of availability of vaccine, self-motivated uptake from OPD, tracking of completion of doses done via an improvised register etc.		

Chapter 4: Recommendations & Conclusions

Vaccination of health workers against HBV remains a key strategy in protecting health workers from nosocomial HBV infection. However our study highlights the many challenges that sub Saharan countries face in ensuring that health workers receive this important vaccine. These include wide variation in endemicity of HBV in the region, competing priorities of many health sectors/institutions e.g. Malaria/HIV AIDS and implementation challenges e.g. which cadres of health workers to provide vaccine to.

Below are our recommendations.

Recommendations

1. While awareness of HBV and vaccine may be high it is not sufficient to drive high uptake of vaccine thus more comprehensive measures to ensure uptake and compliance may need to be incorporated that address other barriers such as cost, availability etc.

2. Where feasible, providing HBV vaccine as part of the default package of provisions for health workers via mandatory/ 'opt out' strategies may be effective in the region. This will likely increase the number who access the vaccine.

Conclusion

Countries in Sub-Saharan region who want to implement HBV vaccination of health workers will need to base their strategies to local epidemiology and guiding principles. Such plans ideally should be guided by locally relevant evidence and experts, and should be comprehensive (not just vaccination but treatment and address factors limiting uptake), and be consistently applied throughout each country.

Thesis References

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