

Factors Affecting HBV Vaccination in a Medical Training College in Kenya: A Mixed Methods Study

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Abstract

Background: Hepatitis B Virus (HBV) is highly endemic in Sub-Saharan Africa with 70 to 90% of the population becoming infected before the age of 40 years. Healthcare workers (HCWs) including healthcare students (HCSs) are at an increased risk of contracting HBV due to occupational exposure. HCS are especially at a high risk because of their inexperience with infection control procedures and insufficient knowledge about the level of risk when dealing with patients. Despite the availability of an effective vaccine, and its recommendation by Kenya's Ministry of Health, few HCW and students are vaccinated. The aim of this study was to evaluate the influence of awareness, attitude, practices, and access factors on hepatitis B vaccination uptake by HCS at Kenya Medical Training College (KMTC).

Methods: This was a concurrent mixed methods study. For the qualitative arm, a structured questionnaire was used to assess the awareness, knowledge, attitudes and practices towards HBV disease and vaccination. Accessibility of the HBV vaccine in the participating campuses was also assessed. Two FGDs were carried out: one comprised of members of the participating campuses while the second comprised members of staff. Quantitative data was analysed using STATA (version 15) while NVIVO (version 11) was used for qualitative data.

Results: Out of 634 students invited to participate in the study, 487 participated (response rate 76.81%). HBV vaccine uptake rate was 76.18% while the non-vaccination rate was 19.10%. Full vaccination was reported by only 21.78% of respondents. The major reason for not receiving the recommended doses was that the vaccine was not available when the students went for it. The qualitative study revealed challenges in the implementation of the vaccination program at KMTC.

Conclusions: A clear policy on mandatory vaccination of students and staff is required. In addition, the HBV vaccine should be readily available, affordable and accessible at all times. Regular review of the curricula in medical colleges to include current vaccination recommendations could aid in improving the vaccination status of healthcare workers in particular and the larger community in general.

Background

Hepatitis B virus (HBV) is one of the two major causes of chronic hepatitis, a precursor to liver cirrhosis and hepatocellular carcinoma (1). In 2015, 257 million people were living with chronic HBV infection. More seriously, 1.34 million deaths occurred from viral hepatitis, higher than those from HIV(1). This trend is expected to increase with time if the strategies outlined for elimination by 2030 are not implemented. Kenya is classified as being highly endemic for HBV with prevalence ranging from 2.1% to 50.6% in different populations (2–9). Measures to combat the disease are therefore desperately needed.

Immunization against HBV is effective and safe. Indeed, it is one of the core synergistic interventions identified for the elimination of HBV(10). In particular, timely vaccination of children less than 5 years, and the introduction of the HBV birth dose (HBV-BD) have been singled out as being critical in eliminating perinatal transmission which carries the highest risk of progression to chronicity (11). In 2017, Kenya

achieved an average coverage of 82% for the 3rd dose HBV childhood vaccination (12), falling short of the 90% recommended coverage. Moreover, it has not yet introduced the HBV-BD despite evidence of prevention against chronic hepatitis (12).

Key to the realization of the goal of mitigating the effect of HBV on public health systems are health care workers (HCWs). Their knowledge on HBV, attitudes towards immunization and practices are likely to determine the success, or lack thereof, of the interventions (13). The impartation of these values can be maximized during training of health care students (HCSs).

During practical placements, HCSs immerse themselves in medical procedures with enthusiasm. This, combined with varying standards of supervision, may place them at risk of blood-borne infections of which HBV is a major concern. HCSs are especially at a high risk because of their inexperience with procedural skills, infection control procedures and also because they may have insufficient knowledge about the level of risk when dealing with patients (14). Due to this risk of occupational exposure to HBV, it is recommended that HCSs receive vaccination before practical placements (15).

Despite this recommendation, vaccination against HBV among HCSs continues to fall below the target (16–19). Some reasons for low vaccination coverage include transitory staff (20); busy schedule (21), lack of money to pay for the vaccine (20) and forgetfulness (21). This is complicated by shortage of skilled HCWs, especially in low income countries, which may compel students to carry out procedures on their own. Unfortunately, the students are inexperienced and may have inadequate training in universal precautions (22,23). Furthermore, the migratory nature of the HCSs during their community oriented practical placements poses a serious challenge to the completion of a vaccination series once started. Enhancing the level of knowledge, perception of HBV vaccine safety and accessibility to the vaccine, would increase the proportion of HCSs vaccinated against HBV. This would in turn have a direct effect on the vaccination coverage of children, as vaccinated HCWs are more likely to recommend vaccination to others.

The aim of this cross-sectional mixed methods study was to investigate the awareness/knowledge, attitudes and practices of HCSs towards HBV vaccination. Further, we investigated the factors affecting the vaccine uptake of the HBV vaccine within KMTTC's campuses.

Methods

Study setting

The study was conducted at the Kenya Medical Training College (KMTTC), the only public middle level health training institution under the Ministry of Health. Currently, KMTTC has 65 campuses with a nationwide distribution with over 34,000 students, 8000 of whom graduate annually. It therefore contributes to 80 percent of Kenya's health workforce. The study was conducted in June and July 2016 during the 2016/2017 academic year at which time there were 55 constituent campuses and a student population of 26,000.

Study design

We used a concurrent mixed methods study design. For the quantitative arm, a structured questionnaire was used to assess (i) the awareness/knowledge of students towards vaccination in general, and HBV vaccination in particular; (ii) their attitudes towards HBV vaccination in general, and the campuses' participation in HBV vaccination of their students in particular; (iii) their practices involving HBV vaccination and prevention of infection; (iv) accessibility of the vaccine to the students in the participating campuses.

For the qualitative arm, we conducted 2 focus group discussions (FGDs). The first FGD comprised 2 Student Representative Council (SRC) members from each participating college; 12 in total. The second FGD comprised 2 members of staff involved in the running of KMTC's vaccine coordinating committee (VCC) from the participating campuses; 12 in total. Informed written consent was obtained from all the participants. The FGDs were carried out in English, which is the language of instruction in KMTC. Tape recorders were used to record the discussions and notes were taken as a backup for recordings.

Sample size estimation for the quantitative study

The sample size was calculated using previously used methods (24). We estimated a prevalence rate of vaccination of 50% due to lack of precise documentation of current KMTC rates. As a multistage sampling design, the sample size was calculated at 80% power with a 95% confidence level. Macfarlane *et al* (1997) asserts that in most immunization coverage cluster surveys, a design effect (DEFF) of approximately two (2) is usually acceptable for a multistage sampling design(25). This study used a smaller DEFF equal to 1.5. Thus, the sample size calculation to assess hepatitis B vaccination coverage, assuming $p = 0.5$, $d = 0.05$ and $DEFF = 1.5$ was as follows:

[Due to technical limitations, this equation is only available as a download in the supplemental files section.]

10% was added to the computed number to give a final sample size of 634 (figure 1).

Statistical analyses

Quantitative data analysis

Data was entered into MS Excel, cleaned and analyzed using STATA (version 15). Continuous data was reported using median/means and range. Categorical data was summarised as frequencies and proportions. Our primary outcome variable was vaccination status. We also sought to find out how many students had been fully vaccinated. We defined full vaccination status as having received 3 or 4 doses of the HBV vaccine; partial vaccination as having received 1 or 2 doses and no vaccination as having received no doses.

Cross tabulations with Pearson's chi square were performed on selected key variables to assess the strength of associations with the vaccination status. Statistical significance was set at p values of less than 0.05.

Qualitative data analysis

The focus group discussions were transcribed and imported into NVivo (version 11). The transcripts were analysed using both pre-existing and emergent themes. Verbatim quotations were selected from the transcripts to illustrate the opinions of the staff and students.

Ethical approval

The study was approved by the Kenyatta National Hospital/University of Nairobi Ethics Research Committee (KNH/UoN ERC); approval number P725/11/2015. Permission was also obtained from KMTc's Ethical Research Committee and its Administration.

Results

A total of 487 students participated in the quantitative part of the study (response rate 77%). Female students were slightly more (50.82%) than male students (49.18%). Students from Nairobi MTC comprised 44.24% of participants while students from the Department of Nursing formed the majority (31.22%) of the participants. Most students were in their 3rd year of study (42.18%) and had been in the college for 3 years (39.09%) (Table 1).

Awareness and Knowledge about Hepatitis B infection

KMTc management and course work were the major sources of information about vaccines and immunization (Figure 2). While the majority of students (94.64%) were aware that HBV vaccination was provided by the College's vaccination program, fewer (53.29%) knew that vaccination against typhoid fever was also available. On the question of infectivity of HBV, 58.59% were aware that HBV is more infectious than HIV and that it can lead to development of liver cancer (59.46%). Majority of them (76.76%) also knew that HBV can be transmitted through contact with open wounds and cuts and transfusion of contaminated blood or blood products (88.09%) among others (Table 2).

Awareness and knowledge about HBV vaccination

Most respondents (88.17%) believe that vaccination against HBV can protect one against acquiring the disease. A majority (75.3%) of respondents knew the correct mode of administration of the vaccine. However, only 43.2% knew that the hepatitis B vaccine is given in three doses. Majority of the students (73.0%) knew that individuals whose jobs involve contact with blood should be vaccinated against HBV (Table 3)

Attitudes towards HBV vaccination

Most of the respondents (95.1%) felt that KMTC should be involved in hepatitis B vaccination of its students. Further, most students reported that they would recommend the vaccine to fellow students with the main reason for recommendation being to protect oneself from infection (Table 4).

Majority of students strongly agreed that all students should get vaccination against HBV before proceeding to their practical placement because of the risk of contracting HBV during procedures. There was also strong agreement that HBV vaccination should be mandatory for all HCWs and students (Figure 3).

Practices

Vaccination against HBV

Majority of the respondents (355/466;76.18%) reported to ever having been vaccinated against HBV. However, full vaccination was reported by only 21.78% of the students with majority of the students having received partial vaccination: 1 dose (19.55%) or 2 doses (50%). No vaccination was reported by 19.10% (89/466) students. The main reason for not having received the recommended 3 doses was that the vaccine was not available when they went for it (35.78%). Most students received the vaccine within their campuses (63.57% in the students/staff clinic; 31.01% within the college premises other than the clinic. In most cases, a college healthcare worker vaccinated the students (73.11%). There were no side effects reported by the majority of vaccinated students (67.80%) while those who reported side effects mostly had swelling at the site of injection (57.58%).

Infection prevention during practical placement

During practical placement, 84.23% of students reported that they always put on gloves when carrying out clinical procedures such as cleaning wounds and cuts. However, 20.99% reported to having had a needle stick injury (NSI). Of those who reported NSIs, 18.28% took no action with only 38.71% reporting the matter immediately and getting post exposure prophylaxis that included the HBV vaccine.

Vaccine Accessibility

Majority of students (85.26%) reported that the cost for HBV vaccination was included in the college fees. However, only 40.76% reported that the HBV vaccine is available in their colleges on a continuous basis, with 41.33% reporting that the schedule for each round of the HBV vaccination program is not being well publicized. Despite this, 70.06% of respondents still prefer to receive the HBV vaccination within their campuses.

Association of vaccine uptake with sociodemographic characteristics

Pearson's chi was used to investigate the association between HBV vaccine uptake and selected sociodemographic characteristics. The campus, year of study and length of time as a student had a statistically significant association with vaccine uptake (Table 5).

Qualitative findings

The main themes that emerged from the two focus group discussions were (i) availability and accessibility of the HBV vaccines in the campuses; (ii) attitude towards the vaccination exercise; and (iii) institutionalization of the vaccination program

Availability and accessibility of HBV vaccine in the colleges

The availability of the vaccine in the campuses, especially in those far away from KMTTC's headquarters (Nairobi), was a recurring challenge. The main factors cited were inadequate HCWs to carry out the vaccination exercise, inconsistent supply of vaccines; lack of appropriate vaccine storage facilities in some campuses, and shortage of supplies needed for the vaccination exercise. Insufficient management support, in terms of vaccine transportation was also mentioned by some campuses located within Nairobi.

"It has not been very easy, at times the vaccines are not there and no storage facility especially outside Nairobi and of course transportation" [Staff, SF]

"...we do not have fridges and at some point, I store in the kitchen fridge where we store milk." [SF]

"Financials [is a challenge] especially when it comes to the purchase of syringes. Personally I have used my money to purchase syringes." [SF]

"Whenever you request [for the vaccine], the response is always 'the headquarters have not delivered'...."[Student, SD]

The lack of consistency of the vaccine supply posed a major challenge in getting the required doses on time. Further, it led to some students completing their practical experience in certain courses without receiving the vaccine at all or only having it after they had already started their practical attachment.

"It [vaccine supply] is not [consistent] because some doses are missing and therefore, we are forced to give unrecommended doses. We have back logs and at times the students refuse to [go to] the wards." [SF]

"They are given, I can say partially. May be dose 1 and 2nd dose delay[s] or go[es] missing." [SF]

".....we don't start the first dose if we are not sure..we cannot give all the doses....in our college we have decided to vaccinate only nurses, clinical officers and asked the occupational therapy students to wait...."[SF]

"The students have to push for the vaccines for about five months"[SD]

"There is laxity in our colleges....they take us for placement without vaccination"[SD]

A major cause of concern that was expressed during both FGDs was the shortage of staff to carry out the vaccination exercise. This led to the campuses using senior students to vaccinate which respondents felt had the potential to expose students to risks of vaccination.

“Workload. We have the role of vaccination amongst other like 40 roles, it’s too much to handle.”[SF]

“Workload.....you find three lecturers are suppose[d] to handle 6 or 15 classes...and they are the people who should give the vaccine too!”[SF]

“.....risky because we use senior students to vaccinate which is really illegal for the student to carry out a procedure alone....”[SF]

“Lack of qualified vaccinators [is a challenge]. In most colleges, we use senior students to help in the vaccination process”[SF]

“.....it [vaccination] is done by senior students who are not qualified....”[SD]

“My main concern is that the vaccination is done by senior students, not health workers...”[SD]

Poor timing of the HBV vaccine doses also arose in the discussions. Due to delays in supply of the vaccine, students were exposed to the practical attachment without having received the recommended doses.

“In the previous years, students were not allowed to report for attachment before vaccination but [these] days they do because there are no vaccines”[SF]

“I wish the supply [of the vaccine] can be consistent. We should get the vaccines before students go for their attachment.....when the vaccine gets late, the students are already in the rural attachment and [it is] very difficult to get them”[SF]

“...I have always [thought], what would happen if one student who has paid[and has not been vaccinated] is infected with HBV?”[SF]

“Yes [we should be vaccinated before practical attachment]because we are going to be exposed in the wards”[SD]

Attitude towards the vaccination process at KMTC

The students felt that the delays in getting the vaccine were due to an unconcerned and corrupt administration. There was a feeling of discontentment among students about the cost charged for the vaccination as opposed to the timeliness of administration of the vaccine. In addition, they felt that the administration had not put in place proper awareness channels about the availability of the vaccine to its students.

"I think the management is not taking this [HBV vaccination] serious[ly], someone is sleeping on the job...."
"[SD]

"We pay for these vaccines and very expensively but we are not given...."[SD].

"Our college is more strict in academics than our health because if they can arrange for our academics for the whole year, then they can still do the same for the vaccines!"[SD]

"The college is not doing enough because there is no communication. They wait for the students to push for it..."[SD]

"...the students fight for it, I can say it is a struggle."[SD]

"...the same people who should give us the vaccine are the same people who release us for attachments without being vaccinated."[SD]

On their part, staff members decried the difficulties experienced in implementing an effective vaccine management system. Poor monitoring and assessment of the vaccine supply chains were reported at all levels. The long procurement process coupled with the campuses' inability to accurately forecast vaccine requirements contributed to frequent stock-outs.

Frequent changes of staff managing the vaccine program affected the quality of data reporting and coordination. Further, the staff felt that the issue of vaccinating students was not considered as a priority due to other competing tasks.

"...some institutions only remember [to issue first dose to] new students and [are] not able to give the second dose. Major issue is procurement."[SF]

"...vaccination comes last since we have HIV and other issues to discuss."[SF]

Students were especially frustrated with the vaccination process. They were concerned about going for their practical placements before the vaccination. On the other hand, there were reports of some students who did not receive the vaccination despite awareness creation.

"...the college is reluctant, the vaccines can be given [once] then the rest is history...not many students get it."[SD]

"The [students who are enrolled in] March intake are exposed to clinical areas before vaccination."[SD]

"There are also absentees [students] who do not follow up."[SD]

Institutionalization and sustainability of the vaccination program

Both students and staff members felt that the HBV vaccination program at KMTC was an important disease prevention strategy for the students. However, it needed to be streamlined for it to be successful.

Some issues that arose that negatively impacted the effectiveness of the vaccination program included shortage of staff, inadequate clinics, vaccine storage facilities and supplies, inadequate communication and centralization of vaccine procurement process. The staff members felt frustrated that they were doing a lot to sustain the program but were not benefiting through vaccination.

However, there were also suggestions for KMTC to stop the vaccination program and allow students to get the vaccine outside the college.

"It should be done by KMTC but the cost should be reduced...I think we can get a new system..."[SD]

"I support it [having vaccination done by KMTC] but all campuses should be given their own vaccines without struggle."[SD]

"The system can be improved...every campus should have its vaccine. Storage should first be improved."[SF]

"I wish the supply can be consistent...."[SF]

"Staffs are only protecting the students while they are not protected."[SF]

"No, I don't support the current structure but I would prefer it outside the KMTC."[SD]

"It should be stopped...I would suggest [that] we get vaccinated outside KMTC and [bring] the receipt."[SD]

Members of staff and members of the Student Representative Council actively participated to ensure the sustainability of the program. Some of the suggestions given to improve the program included timely availability of the vaccine to justify value for money. The College needed to disseminate the vaccination policy and manual, and carry out sensitization of all stakeholders. New members in the campus vaccine coordinating committees needed training in managing the program.

"We are volunteering, [giving] timely communication and co-coordinating."[SF]

"Being there when things are not working out."[SF]

"We would like the college policy to be disseminated."[SF]

"The management should allow the process to continue so as to help us protect ourselves from HBV."[SF]

"It [vaccination] will be difficult only if it's outside the KMTC. It [should] be done in KMTC but under one condition, system be changed." [SD]

Triangulation of Quantitative and Qualitative findings

Delay in receiving the HBV vaccine was highlighted in both the qualitative and quantitative studies. The FGDs provided insight into the causes of the delays including centralization of the vaccine procurement

process in the headquarters in Nairobi thus necessitating transport of the vaccine to campuses, and lack of transportation and storage facilities at the peripheral facilities. Other issues included inadequate staff members and management support. Although the quantitative study showed a large majority of students supported the continuation of the vaccination program, the qualitative study on the contrary brought out the dissatisfaction of the participants with the current program.

Discussion

Our study showed that a majority of the HCSs were aware and knowledgeable about HBV infection and its various modes of transmission. This is similar to what was observed in a study done in Cameroon that showed that a majority of medical students had adequate knowledge on HBV infection and vaccine, and HBV transmission (26). However, the findings were different from those found among medical students in India, Syria, Nigeria and Lao PDR, which found poor knowledge, and lack of awareness about hepatitis B, its routes of transmission, risk factors, and modes of prevention (27–30).

Of the students surveyed, only 53.12% of HCSs would recommend HBV vaccination to newborns. While this is a slight majority, more HCSs need to know about the critical role of HBV-BD in the elimination of HBV. However, these findings could be due to the fact that the HBV-BD has not yet been rolled out in the public health sector in Kenya and therefore may not be in KMTTC's curriculum. It is imperative that Medical colleges' curricula be regularly updated with recommended guidelines on vaccination. In addition, only 46.20% of the students reported that they would recommend catch-up vaccination for children and adolescents who did not receive the vaccine as infants. Given that catch-up vaccination of adolescents is important for a highly endemic country like Kenya, efforts should be made to inform HCSs on existing recommendations. Due to their critical future role in dissemination of knowledge and raising awareness among their communities, more educational efforts should be exerted on the students to enable them contribute to the prevention of HBV (30).

In this study, 76.18% of students had ever been vaccinated against HB. However, full vaccination coverage (3 or 4 doses of the HBV vaccine) was only reported by 21.78% of respondents. This was lower than the rate reported among HCSs in Greece (31) but higher than that found in a study among medical students in Cameroon which showed a complete vaccination rate of 16.81% (26). Non-vaccination was reported by 19.10% of respondents which was lower than the 33.2% found among students in Uganda (31). The current findings may be explained by the existence of an organized and structured program at KMTTC to encourage the uptake of the HBV vaccine by students.

Our FGDs revealed the unavailability of the vaccine in most campuses as being associated with delays in centralized procurement process and inability of staff to accurately forecast the quantities required by their students. The College's vaccination policy guidelines and manuals had also not been well disseminated across the campuses. Similarly, lack of a clear policy on HBV vaccination in medical schools partly explained the low vaccine coverage in a study in Cameroon (26). Furthermore, some students deliberately absented themselves from receiving the vaccines while others expressed fear of

being vaccinated by senior students. Similar findings were presented in a study in Greece which showed that one third of the unvaccinated students declared fear over HBV vaccine safety (31).

The respondents' year of study and duration at KMTC were significantly associated with vaccine uptake. These findings are similar to those found among university students in Malaysia and Uganda(31,33). This is probably associated with the increased awareness of HBV by senior students and the fact that they could demand for the vaccine as reported in focus group discussions.

Limitations

The vaccination status was based on self-report by the respondents and not by measuring the hepatitis B antibody titers. It is possible that the study design suffered recall bias. The participants may also have deliberately given wrong information of the doses received. All participants were drawn from a middle-level public medical training institution, and hence may not be representative of medical students in universities and other HCSs in private training institutions. However, the mixed method design, the large number of campuses and large sample size could increase the validity of our study

Conclusions

Low full vaccine uptake was observed among the HCSs despite adequate awareness and knowledge of HBV disease, vaccination, and modes of transmission. The main reason for the low rate of coverage was unavailability of the vaccine probably due to inadequate funding of the vaccination program. Other contributing factors included shortage of vaccinators, insufficient communication and poor dissemination of policy guidelines on HBV vaccination. Given the risk of occupational exposure and the effectiveness of the vaccine to eradicate the disease, the College management should provide a clear policy on mandatory vaccination of students and staff. The vaccine should be readily available, affordable and accessible at all times. In addition, adoption of education initiatives focused toward increasing awareness, prevention activities and seeking care in case of exposure to infected body fluids.

Abbreviations

HBV- Hepatitis B Virus

HBV-BD: Hepatitis B vaccine birth dose

HCWs- Health care workers

HCSs- Health care students

SRC- Student Representatives' Council

VCC- Vaccine Co-ordinating Committee

SD- Student

SF- Staff

Declarations

Ethics approval and consent to participate

Ethical approval for the research was obtained from the Kenyatta National Hospital/ University of Nairobi (KNH/UoN) Ethics Research (P725/11/2015). All participants provided written informed consent.

Consent for publication

Not applicable.

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

ANM and LCB contributed to the conception, design and interpretation of data; ANM analysed the quantitative data. ANM and LCB analysed the qualitative data. Both authors were involved in drafting the manuscript and its revision for important intellectual content. Both authors read and approved the final manuscript.

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Tables

Table 1 Demographic characteristics of the respondents

Factors	Characteristic	Frequency	Percentage(%)
Age (n=449)	Mean (Std.Dev)	22.5 (2.81)	
	Median	22	
	Range	18,40	
Sex (n=486)	Male	239	49.18
	Female	247	50.82
Campus (n=486)	Kisii	53	10.91
	Kakamega	57	11.73
	Nairobi	215	44.24
	Embu	32	6.58
	Eldoret	60	12.35
	Portreiz	69	14.20
Department (n=474)	Medical Laboratory Sciences	83	17.51
	Nursing	148	31.22
	Biomedical Engineering	50	10.55
	Environmental Health	32	6.75
	Physiotherapy	20	4.22
	Medical Imaging Services	26	5.49
	Clinical Medicine	58	12.24
	Pharmacy	57	12.03
Year of Study (n=486)	1st year	118	24.28
	2nd year	158	32.51
	3rd year	205	42.18
	4th year	5	1.03
Duration at KMTC (n=486)	< 1 year	106	21.81
	1 year	71	14.61
	2 years	106	21.81
	3 years	190	39.09
	>= 4 years	13	2.67

Table 2 Student responses to the modes of transmission of HBV

	Yes <i>n</i> (%)	No <i>n</i> (%)
Transfusion of contaminated blood or blood products (n=451)	429 (95.12)	22 (4.88)
Unprotected sexual intercourse (n=430)	310 (72.09)	120 (27.91)
Mother to child transmission (n=407)	301 (74.96)	106 (26.04)
Scarification, tattooing and shaving (n=381)	226 (59.32)	155 (40.68)
Handling contaminated surfaces (n=397)	271 (68.26)	126 (31.74)
Handling contaminated equipment (n=401)	294 (73.32)	107 (26.68)
Splashes from contaminated fluids (n=398)	334 (83.92)	64 (16.08)
Needle-stick injuries (n=423)	392 (92.67)	31(7.33)
Cosmetic procedures (n=395)	249 (63.04)	146 (36.96)
Dental procedures (n=377)	223 (59.15)	154 (40.85)
Injecting drug use (n=417)	372 (89.21)	45 (10.79)
Sharing eating utensils (n=400)	80 (20.00)	320 (80.00)

Table 3 Students' responses to groups of people who should receive vaccination against HBV

	N	%
Newborn babies (n=374)	199	53.12
Children and adolescents who were not vaccinated in infancy(n=482)	225	46.20
Individuals with multiple sexual partners (n=482)	111	22.79
Individuals seeking treatment for STIs or HIV (n=482)	101	20.95
Injecting drug users (n=481)	143	29.73
Individuals whose jobs involve contact with blood (n=482)	352	73.03
Patients undergoing dialysis (n=482)	123	25.52
Individuals with chronic liver disease (n=479)	146	30.48

Table 4 Students' responses to whom they would recommend the vaccine and reasons for recommendation

Would you recommend the HBV vaccine for the following groups of people?

	Yes (<i>n</i> %)	No (<i>n</i> %)
Fellow students (n=452)	442 (97.79)	10 (2.21)
Newborns (n=356)	233 (65.45)	123 (34.55)
Infants (n=348)	234 (67.24)	114(32.76)
Adolescents (n=393)	356 (90.59)	37(9.41)
Adults (n=390)	345 (88.46)	45 (11.54)

Why would you recommend the HBV vaccine?

To protect oneself (n=449)	445 (99.11)	4 (0.89)
To protect patients (n=378)	338 (89.42)	40 (10.58)
To protect your sexual partner (n=357)	261 (73.11)	96 (26.89)
To protect others (n=393)	361 (91.86)	32 (8.14)
To prevent mother-to-child transmission (n=375)	301 (80.27)	74 (19.73)

Table 5 Association of vaccine uptake with selected sociodemographic characteristics

	One dose	Two doses	Three doses	Four doses	Can't recall	Total	P-value
Gender							
Male	32	99	46	2	18	197	0.403
Female	47	103	37	3	16	16	
Total	79	202	83	5	34	403	
Campus							
Kisii	2	31	4	0	4	41	<0.001
Kakamega	5	23	13	1	3	45	
Nairobi	26	101	39	1	14	181	
Embu	2	20	8	1	0	31	
Eldoret	7	18	15	1	8	49	
Portreitz	37	9	3	1	6	56	
Total	79	202	82	5	35	403	
Department							
Medical Laboratory Sciences	3	30	17	1	6	57	0.012
Nursing	34	60	18	2	13	127	
Biomedical Engineering	4	18	7	1	4	34	
Environmental Health	2	20	8	1	0	31	
Physiotherapy	3	12	5	0	0	20	
Imaging	5	5	7	0	4	21	
Clinical Medicine	14	24	8	0	0	56	
Pharmacy	11	20	10	0	6	47	
Total	76	199	80	5	33	393	
Year of Study							
1 st year	38	14	7	1	18	78	<0.001
2 nd year	25	82	15	1	8	131	
3 rd year	15	104	60	3	9	191	
4 th year	1	1	1	0	0	3	
Total	79	201	83	5	35	403	
Length of time as student							
<1 year	32	11	6	1	17	67	<0.001

1 year	16	29	10	0	4	59
2 years	16	61	12	1	3	93
3 years	14	99	53	3	11	180
>4 years	1	1	2	0	0	4
Total	79	201	83	5	35	403

Figures

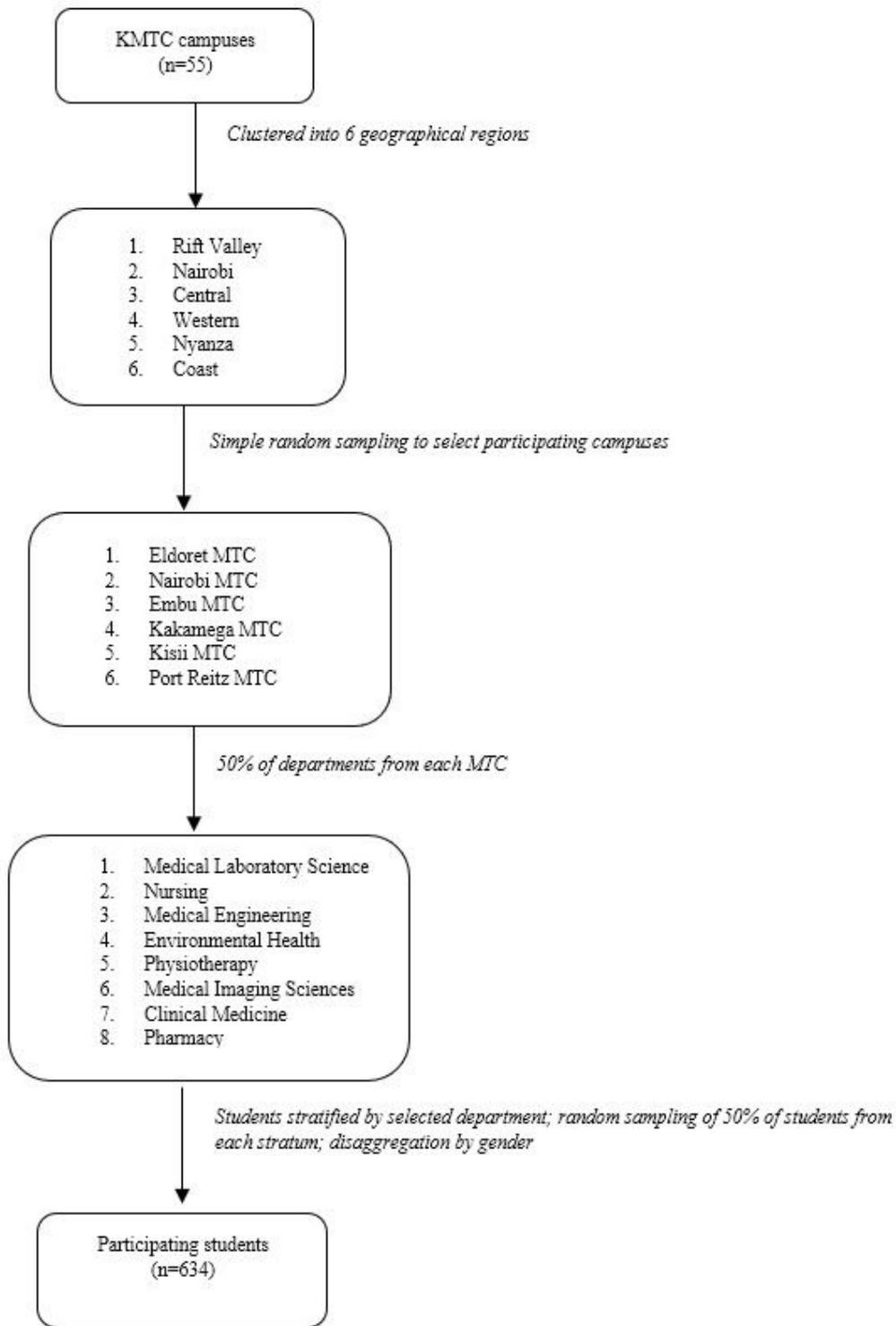


Figure 1

Flow chart showing participant recruitment for the quantitative study.

Source of Information about Vaccines by Department

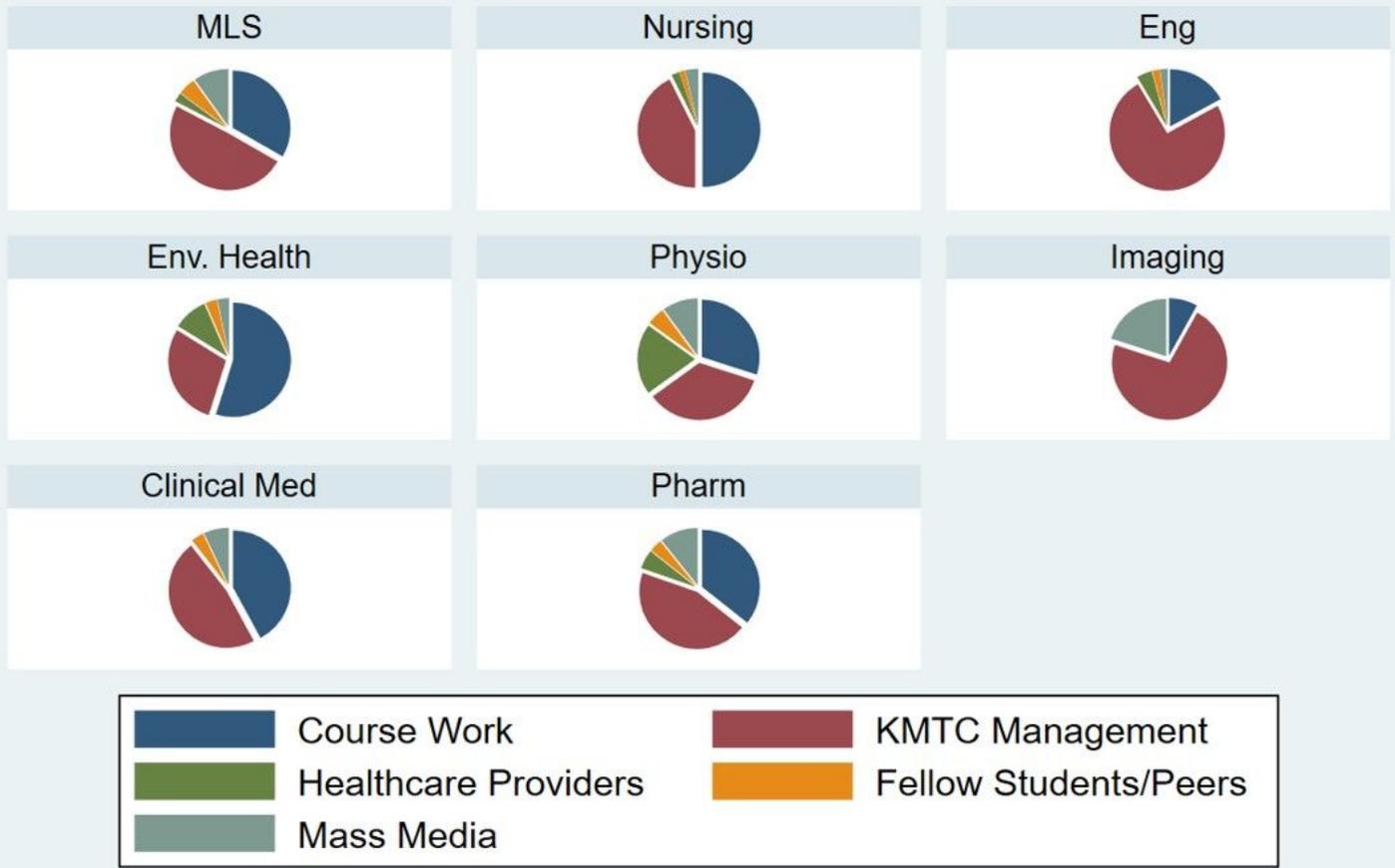


Figure 2

Pie charts showing the sources of information about vaccines by department. MLS (Medical Laboratory Science); Env. Health (Environmental Health); Eng (Medical Engineering); Physio (Physiotherapy); Clinical med (clinical medicine); pharm (Pharmacy)

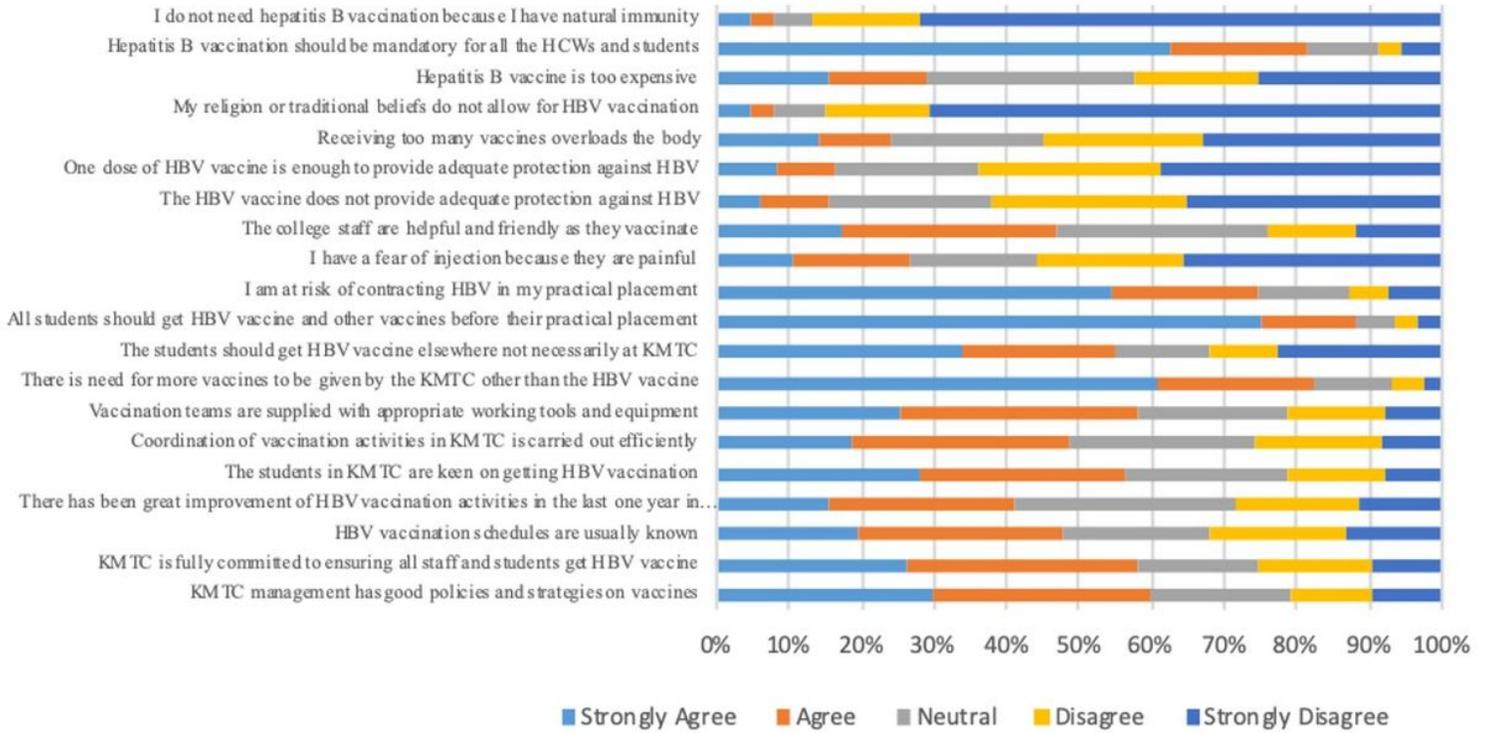


Figure 3

Students' attitudes towards HBV vaccination and KMTC's involvement in vaccination

Supplementary Files

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