



ADDIS ABABA UNIVERSITY

COLLEGE OF HEALTH SCIENCES

SCHOOL OF MEDICINE DEPARTMENT OF SURGERY

**KNOWLEDGE, ATTITUDE AND UTILIZATION OF VACCINATION FOR
ASPLENIC PATIENT AND ASSOCIATED FACTORS AMONG HEALTH
CARE PROVIDERS IN SELECTED PUBLIC HEALTH INSTITUTES OF
ADDIS ABABA, ETHIOPIA IN 2024**

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List of Acronyms

AARHB.....	Addis Ababa Regional Health Bureau
DIC.....	Disseminated Intravascular Coagulation
GP.....	General Practitioner
Hib.....	Haemophilus Influenzae type b
HIV.....	Human Immune Deficiency Virus
HO.....	Health Officer or Public Health Officer
HS.....	Hereditary Spherocytosis
IgG.....	Immunoglobulin G
IgM.....	Immunoglobulin M
ITP.....	Immune Thrombocytopenia
NGO.....	Non Governmental Institution
OPSSI.....	Overwhelming Post-Splenectomy Sepsis
PALS.....	Periarteriolar Lymphoid Sheaths

Abstract

Background: Overwhelming post-splenectomy infection (OPSI) remains a long-term risk in asplenic patients, which may be reduced by appropriate preventive measures such as vaccination, health education and by administering prophylactic antibiotics.

Objectives: the aim of this study to determine knowledge attitude and utilization of vaccination for asplenic patient among health professionals who are working in selected health facilities of Addis Ababa.

Methods: from June 1 2024 to December 10 2024, research employed a facility based Cross-sectional study in Addis Ababa. A total of 374 health care providers randomly selected from conveniently selected 5 Hospitals and 5 Health Centers. Self-administered structured questionnaire was used to collect the data. Epi-data version 3.1 was used to enter the data and analysis was done using STATA version 14, software. Descriptive statistics were produced, including frequency, percentage, mean, and median. To protect data confidentiality, no personal information about study participants was collected during data collection.

Results: The aggregate knowledge of the participants was 451.4 (45.1%), indicating that they knew a little about vaccination for asplenic patients. General practitioners, and resident physicians demonstrated significantly higher odds of having good knowledge compared to nurses with 14.13 times (AOR = 14.13; 95% CI: 4.49–44.41; $p < 0.001$) and 18.18 times (AOR = 18.18; 95% CI: 9.45–34.96; $p < 0.001$) respectively. Having good Knowledge indicating it as the strongest predictor of vaccine utilization for asplenic patients (AOR = 6.86, 95% CI: 2.56–18.32, $p < 0.001$).

Conclusion This study shows the overall knowledge of health care provider about vaccination for asplenic patient is low which has significant effect on the utilization of vaccination. So it is better to create awareness about the susceptibility asplenic patients for overwhelming post splenectomy sepsis to improve vaccine utilization.

1. Introduction

The spleen is the largest lymphatic organ in the body and plays a crucial role in the immune response through both cell-mediated and antibody-mediated processes. [8,9] Its lymphoid tissue contains macrophages that help destroy pathogens by opsonizing particles coated with immunoglobulin G (IgG). Additionally, the spleen is the primary site for producing immunoglobulin M (IgM), which is essential for the rapid clearance of pathogens from the bloodstream. Splenic macrophages also target encapsulated organisms, which are particularly more virulent because their polysaccharide capsules help them escape the adaptive immune response by hiding their immunogenic bacterial components. This capsule protects these bacteria from being engulfed by phagocytes and from complement-mediated lysis. Therefore, the spleen is vital for eliminating these harmful organisms. [9] Another key function of the spleen is filtering out aged erythrocytes. Approximately 10–15% of the body's blood volume is processed through the spleen every minute, enabling it to remove malformed and defective red blood cells from circulation. Erythrocytes must cross through tiny openings in the splenic vasculature to re-enter the bloodstream. While healthy erythrocytes can easily pass through, older ones get trapped due to their inability to fit through these narrow passages. Consequently, these senescent and damaged erythrocytes are destroyed by macrophages in the spleen, and their components are recycled. [6,7]

Splenectomy is often required for various conditions, including trauma, hematological disorders, and malignancies. The prevalence of splenectomy is approximately 9.75 per 100,000 individuals. [1] Patients who have undergone splenectomy are at a higher risk for severe infections, such as overwhelming post-splenectomy sepsis (OPSSI), [2,3] which can manifest as disseminated intravascular coagulation, fulminant sepsis, or meningitis. This condition has a mortality rate of up to 70%. [5] However, preventive measures like immunization and timely, appropriate antibiotic use can help protect these patients from developing OPSI as well as death.

The prevalence of asplenia in the general population of Ethiopia is currently unknown; many medical centers are performing splenectomies for those in need. Unfortunately, there has not been a survey conducted in Addis Ababa or elsewhere in Ethiopia to assess the knowledge, attitudes, and vaccination utilization for asplenic patients among health professionals.

1.1.Statement of the problem

Asplenic patients have a long-term susceptibility to serious, potentially life-threatening infection,[10] which varies in clinical presentation from mild pneumonia to fatal overwhelming sepsis.[11,12] Most instances of serious infection are due to encapsulated bacteria such as *Streptococcus pneumoniae* (pneumococcus), *Haemophilus influenzae* type b (Hib) and *Neisseria meningitidis* (meningococcus)[7] Other infections which may have serious consequences include *Escherichia coli*? malaria,[9] babesiosis[10].

Lack of compliance with long-term antibiotic prophylaxis in-consistent care by health care providers due to lack of awareness about vaccination for asplenic patients and prophylactic antibiotic usage make asplenic patients prone to overwhelming infection as well as death[10].

2. Literature review

2.1.The Spleen

2.1.1. Embryology

The spleen begins to develop around the sixth week of fetal growth, developing from the left layer of the dorsal mesogastrium in the upper region. It starts as several small nodules that eventually fuse to create a lobulated structure. In adults, the notches along the superior border of the spleen are indicative of its development from multiple segments. As the stomach rotates during intrauterine development, the left mesogastric surface connects with the peritoneum above the left kidney, leading to the formation of the lienorenal ligament. The cells that contribute to the spleen's hematopoietic function originate from the yolk sac and the dorsal aorta. By the second trimester, the spleen is capable of producing and releasing both red and white blood cells into the bloodstream. (7,8,9)

2.1.2. Gross Anatomy

Thin, flexible fibro elastic connective tissue which shields the spleen is a capsule that offers both protection and the ability to expand. This capsule spreads inward, dividing the spleen into smaller internal units called lobules. As an intra-peritoneal organ, visceral peritoneum covers the spleen almost completely, with the exception of the hilum, where nerves, splenic vessels, and ligamentous attachments are located. The spleen has two distinct surfaces: the diaphragmatic (or lateral) surface, which is smooth and convex, and the visceral (or medial) surface, which is concave and irregular, bearing imprints from adjacent organs. The diaphragmatic surface exhibits markings from ribs 9 to 11, whereas the visceral surface displays imprints from the left colic flexure (colic area), the stomach (gastric area), and the left kidney (renal area). (10,11,14)

2.1.3. Microscopic Anatomy and Functions of the Spleen

The capsule of the spleen, made up of dense irregular connective tissue, extends inward to form numerous septa known as trabeculae, which penetrate the spleen's parenchyma. Both the capsule and the trabeculae contain myoepithelial cells that contract to release stored blood into the circulatory system during times of need, such as intense physical activity or significant blood loss. The parenchyma, or pulp, of the spleen consists of two distinct types of tissue: white pulp and red pulp, each serving specialized functions.

The white pulp, which makes up about 25% of the spleen's volume, is primarily composed of lymphocytes. It includes periarteriolar lymphoid sheaths (PALS), which are dominated by T-cells, and lymphatic nodules containing B-cells. The remaining 75% of the spleen is occupied by the red pulp, which contains splenic venous sinuses, cords of Billroth, and perisinusoidal macrophages. A transitional region called the marginal zone lies between the white and red pulp, filtering pathogens from the blood and presenting them to the lymphocytes in the white pulp for immune response [14].

2.2.Splenectomy

Splenectomy, the surgical removal of the spleen, is frequently executed as a life-saving procedure in cases of severe trauma with uncontrollable bleeding. Additional causes for splenectomy include certain hematological disorders, malignant conditions, and diagnostic purposes [15]. Worldwide, the amount of splenectomy is around 6.4 to 7.1 per 100,000 people annually. Trauma and hematological disorders are the chief reasons, each accounting for around 25% of cases [16]. Splenic rupture due to blunt or penetrating abdominal trauma, resulting in intra-peritoneal bleeding and hemodynamic instability, often necessitates splenectomy [17]. Common hematological conditions that may require splenectomy include idiopathic thrombocytopenic purpura (ITP), sickle cell disease, thalassemia, and hereditary spherocytosis (HS).

2.2.1. Infections Following Splenectomy

Though the presence of spleen is not a must for the survival of human beings; its removal still has different concerns. Until 1952, when King and Schumacher revealed the risk of OPSI, the spleen was considered as needless organ and being without spleen considered to be quite safe [16]. Nowadays, there are clear evidence that being without spleen expose patients for increased risk of infection and thromboembolism [18]. The factors responsible for an increased incidence of infection and propensity for severity following a splenectomy include insufficient opsonizing filter function of the spleen, late and reduced creation of immunoglobulin (Ig), lack of splenic macrophages, and minimal tufts production [16] will contribute for inefficient immune response of asplenic patients.

Reactive Thrombocytosis and leukocytosis can be immediately followed after splenectomy. The thrombocytosis usually resolves within 6-12 months, whereas the leukocytosis may persist for many years following the removal of the spleen [20]. Leukocytosis is mainly granulocyte-driven, as raised levels of neutrophils are usually appreciated after splenectomy [21]. Beside with the quality of erythrocytes, the extents of lymphocyte cohorts are also altered. Though the total B lymphocytes remain same, a significant decrement in the levels of memory B cells and switched B cell proportions are usually encountered 150 days following to splenectomy [22]. This acts as a particular propensity to infections caused by polysaccharide-encapsulated bacteria and is accountable for a weakened immunological response to polysaccharide vaccines [23,24]. These hematological and immunological alterations predispose splenectomized individuals to various infections. Succeeding splenectomy, individuals end up with a raised risk of infection, mainly from encapsulated Gram-negative pathogens, i.e., *Capnocytophaga canimorsus* and *Bordetella holmesii* [25,26], and intraerythrocytic parasites, like malaria and *Babesia* [27,28].

2.2.2. Overwhelming post-splenectomy infection

The main long-term problem of splenectomy is OPSI, also known as post-splenectomy sepsis syndrome, which is characterized as a generalized non-specific flu-like prodrome followed by rapid deterioration to full-blown fulminant septic shock within 24-48 hours of the onset [29]. Even though there is no specific diagnostic criterion for OPSI, rapid identification followed by proper management can prevent further morbidity and mortality [30]. The occurrence of OPSI subsequent from splenectomy is 0.1-0.5%, with a death rate of up to 50% [31].

The first 3 years of post-splenectomy considered peak for the development of infection; though, the risk remains elevated throughout an individual's lifespan, indicated by the reported incident of cases of fulminant infection 20 years after splenectomy [32]. Immunosuppressed individuals (e.g., HIV-infected), Children under 2-5 years of age, those who have had splenectomy for different reasons have greater risk for the development of OPSI [16].

Recent studies suggest that *Neisseria meningitidis* and *Haemophilus influenzae* (type b) are common etiologic agents of infections following splenectomy [33,34]. Less common organisms include Gram-negative bacteria such as *Pseudomonas aeruginosa*, *Capnocytophaga canimorsus*, *Bartonella* spp., and *Babesia* spp [35]. Pneumococcal infection is by far the most common with an associated mortality rate of up to 60% [24,28]. This might guarantee to the

concomitant administration of penicillin and pneumococcal vaccine in splenectomized individuals [36].

2.3.Prevention of post-splenectomy infection

With the presence of effective therapy, fatality from OPSI remains high. This tells as the importance of put on preventive measures in the actual care of splenectomized patients. The British Committee for Standards in Haematology has prepared guidelines for the prevention and treatment of infections in the asplenic or hyposplenic population. These guidelines can be loosely split into three groupings: patient education, immunization, and antibiotic prophylaxis [33].

2.3.1. Health Education

Asplenic and hyposplenic patients should be aware that they have a modest lifetime increased risk of severe or overwhelming infection with the pathogens listed above. Both the risk of infection and the accompanying mortality appear to be around two to three times more commoner than in the general population. One survey approximations the risk of overwhelming post-splenectomy sepsis to be 1.3/1000 per years [45].

2.3.2. Vaccination

Different forms of vaccines are available for the most common organisms this includes the 23-valent pneumococcal polysaccharide vaccine, a 7-valent protein-conjugated pneumococcal vaccine, *Hemophilus influenzae* type B vaccine, and meningococcal vaccine [39]. The polysaccharide-based pneumococcal vaccine is recommended for all adults at increased risk of pneumococcal infection, and particularly the asplenic patients [40]. The Centers for Disease Control and Prevention in the US recommend (revaccination every 6 years) and the British Committee for Standards in Haematology which recommends (revaccination every 5-10 years) for the prevention of OPSI, at the same time emphasizing the rather frequent need for shorter intervals between revaccinations to keep antibody concentrations at a level sufficient by probability to confer protection [41, 42]. Unfortunately, fatal pneumococcal sepsis has been reported in asplenic vaccinated patients; it remains advisable to offer splenectomized patients to have vaccination due to their increased risk of developing severe disease and because the vaccine itself poses minimal risk. Jockovich [43] reported no OPSI among patients vaccinated before splenectomy; however, 10.4% of patients who did not receive vaccination developed OPSI. In

addition, 5% of patients who were given vaccination after splenectomy may developed OPSI. For elective splenectomy, the vaccine should be given at least 2 weeks prior to surgery [43, 44].

Table 1. Recommended dose of vaccination for adult asplenic patients

Recommended vaccine	Dose of the vaccine	Route of administration	Time of administration
In-hospital protocol			
Pneumococcal 13-valent conjugate (PCV13: Prevnar 13)	0.5 mL	IM	On the day of discharge or day 14, whichever comes first
Haemophilus influenzae type b vaccine (Hib: ActHIB)	0.5 mL	IM	On the day of discharge or day 14, whichever comes first
Meningococcal vaccine (Menactra)	0.5 mL	IM	On the day of discharge or day 14, whichever comes first
Meningococcal serogroup B (Bexsero)	0.5 mL	IM	On the day of discharge or day 14, whichever comes first
Short-term follow-up			
Pneumococcal polysaccharide (PPSV23: Pneumovax 23)	0.5 mL	IM	Two months after the initial vaccination
Meningococcal vaccine	0.5 mL	IM	Two months after the initial vaccination
Meningococcal serogroup B	0.5 mL	IM	Two months after the initial vaccination
Long-term follow-up			
Pneumococcal polysaccharide	0.5 mL	IM	5 years after the first dose
Meningococcal vaccine	0.5 mL	IM	Every 5 years
Seasonal influenza vaccine	-	-	Annually

2.3.3. Antibiotic prophylaxis

In addition to vaccination use of antibiotic prophylaxis, further reduces the risk of infection and poor outcomes [4]. The risks and benefits of daily antibiotic prophylaxis should be discussed with all patients and generally favor its use in asplenic and hyposplenic patients who are at highest risk of severe infection (eg, children <5 years old, immunocompromised patients, patients with a history of severe infections, and patients in the first year post-splenectomy). All patients should be advised to keep an emergency supply of antibiotics on hand to be used for the development of fever or other signs of systemic infection and to seek medical care immediately if these symptoms develop [Table 2].

Table 2. Oral antibiotic prophylaxis and empiric emergency Antibiotics in asplenic and hyposplenic adults

Strategy	Preferred Option	Alternative option
Daily prophylaxis	<ul style="list-style-type: none"> ➤ Penicillin V 250 mg 2x daily or ➤ Amoxicillin 500 mg 2x daily 	<ul style="list-style-type: none"> ➤ Cephalexin 250mg BID ➤ Azithromycine 250 mg Daily
Emergency Antibiotics for fever or suspected infections	<ul style="list-style-type: none"> ➤ Amoxicillin-clavulanate 875 mg/125 mg 2 x daily 	<ul style="list-style-type: none"> ➤ Cefdinir 300mg 2x daily or ➤ Levofloxacin 750mg daily or ➤ Moxifloxacin 400 mg daily

Adapted from up-to-date 2023

3. Objectives of the study

3.1.General objective

To determine knowledge attitude and practice of health professionals towards vaccination for asplenic patients in public health institutes of Addis Ababa, Ethiopia in 2024

3.2.Specific objectives

- To determine knowledge of health care providers' about vaccination in selected public health institutes of Addis Ababa, Ethiopia, 2024.
- To assess attitude of health care providers towards vaccination for post splenectomy patients in selected public health institutes of Addis Ababa, Ethiopia, 2024.
- To determine the level of practice of vaccination for post splenectomy patients in selected public institutes of Addis Ababa, Ethiopia 2024.

4. Materials and Methods

4.1.Study Area and Period

This study was conducted in Addis Ababa, the capital of Ethiopia and the host city for the African Union and the United Nations World Economic Commission for Africa. Located at 9° 1' 48" North and 38° 44' 24" East, the city sits at an average elevation of 2,500 meters above sea level. With a population of over 3 million (3,945,000) and an annual growth rate of 2.1% (based on Ethiopia's Central Statistical Agency population projection from July 2023), Addis Ababa is administratively divided into 11 sub-cities and 116 woredas.

The city has 11 public hospitals, 6 of which are managed by the Addis Ababa Regional Health Bureau (AARHB) and the remaining 5 by the Ethiopian Federal Ministry of Health. Additionally, it includes 103 public health centers, 3 private NGO health centers, 76 NGO clinics, and more than 700 privately operated clinics. According to the Addis Ababa Food, Medicine, and Health Care Administration Authority's annual review meeting report from 2009 EFY (2017/2018 Gregorian Calendar, unpublished), the public health facilities under the Addis Ababa City Administration employ a total of 1,142 health professionals.

From the available health institutions, 10 were conveniently selected for this study: 5 hospitals (Tikur Anbessa Specialized Hospital, Ras Desta Memorial Hospital, Zewditu Memorial Hospital, St. Peter Specialized Hospital, and Minillik II Comprehensive Hospital) and 5 health centers

(Churchill, Maychew, Janmeda, Entoto Anba, and Hidase). This study was conducted from June 1 to December 10, 2024.

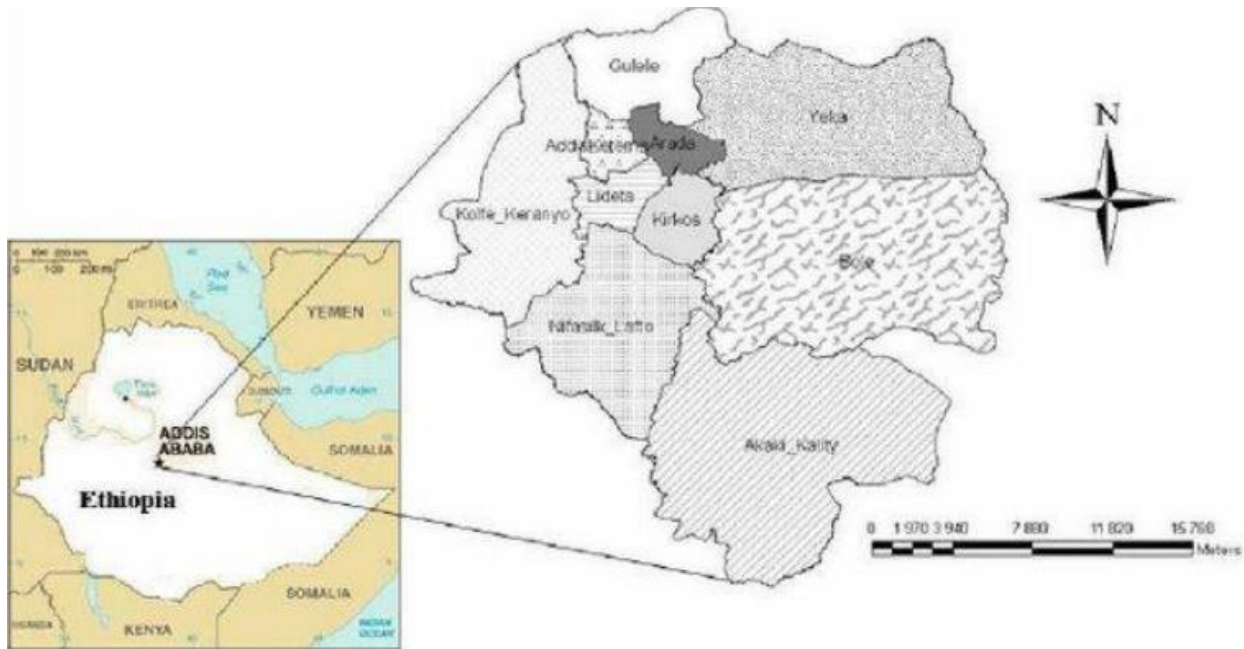


Figure 1 Map of Addis Ababa obtained from google earth 2024

4.2. Study Design

Institution based cross-sectional study

4.3. Source population and study population

4.3.1. Source population

The participants of this study were all health care providers working in Addis Ababa City Administration public health facilities.

4.3.2. Study population

The study population was all health care providers working in the above selected health center and hospitals.

4.4. Inclusion and exclusion criteria

4.4.1. Inclusion criteria

Randomly selected volunteer health care providers who are currently working in the above health institutions which includes nurses, midwives, health officers and general practitioners, resident's physicians.

4.4.2 Exclusion criteria

Those providers who are in annual, maternity, sick leave, not found within data collection period and not volunteer to participate in the study were excluded.

4.5. Sample size

The sample size determined using a single population proportion formula based on the following Assumption.

$$n_o = \frac{Z^2pq}{e^2} = \frac{(1.96)^2(.5)(.5)}{(.05)^2} = 385$$

The assumption was that; n= the desired sample size; Z = is critical value for normal distribution at 95% confidence level which equals to 1.96(Z), e is the desired level of precision, p is the estimated proportion of knowledge, attitude and practice to give vaccination for asplenic patient, that will present in the study population, and q is 1-p. The study which determine proportion of knowledge and attitude and practice towards the utilization of vaccination for pre or post splenectomy patients was not found in Ethiopia so we utilize the assumption of P 0.5 and is the margin of error to be tolerated (5%) and the nonresponse rate will be 10 % so the final sample size will be 384 + 39 = 424

4.6. Sampling technique

Due to lack of time unavailability adequate resource and funding; the sampling technique was convenient sampling so Tikur Anbesa Specialized hospital, Zewditu memorial hospital, St peter Specialized Hospital, Jan Meda, Maychew, Hidase and Churchill Health centers are selected based on their proximity to the principal investigator.

4.7. Data collection procedures

Data was collected using structured questionnaire

4.8. Study variables

4.8.1. Dependent variables:

Knowledge, attitude, Provision or prescribing of vaccine for asplenic patient

4.8.2. Independent variables:

Independent variables include Working facilities (hospital, health center), socio demographic factors (age, sex, profession (Nurse, HO, General practitioner, Resident, service year), training (pre-service and in-service Training).

4.9 Operational definitions

Knowledge of vaccination for asplenic patient: assessed using 9 knowledge -based questions. Each accurate response was worth one point, while any incorrect response worth nothing. As a result, the total knowledge score were calculated out of (9 points). The rank cutoff will be determined using the mean score of vaccination for asplenic patient knowledge (5). Respondents who received a score of 0–4 regarded to have low knowledge, while those who had a score of 5 out of 9 questions considered to have strong knowledge (Annex 3).

Attitude towards vaccination for asplenic patient: assessed using` attitude scoring method. The attitude score for each of the personnel will be obtained by adding up the scores for correct answers given to the 10 questions (Annex 4).

Utilization of vaccination for asplenic patient: care provider who had prescribed or gave vaccine for asplenic patient during their health care practice will be considered utilized.

Health care Providers who had been ever refused to prescribe or to give vaccination for asplenic or potential to be asplenic patients will be considered not utilized. (Annex 5).

4.10 Data quality assurance

To ensure the tool's uniformity the data collectors and their supervisors were receive the necessary training in data gathering techniques, processes and instructions in order to conduct the surveys. The instrument pretested on 20 health care providers at a public health center and hospital which was not be part of the study site. Field supervisors were rechecked the cleanliness and correctness of the filled questionnaire while the data being collected or after the data collected.

4.11 Data processing and analysis

The data visually reviewed for correctness before being coded and entered into Epi-Data version 3.5.1 and it was exported to STATA version 14. For each variable, descriptive statistics such as frequency, percentage, mean, and median were generated. Using bivariate

logistic regression, the presence of any association between independent and dependent variables evaluated. Variables with a P 0.2 in the bivariate logistic regression analysis were included in the final multivariable logistic regression model under the assumption that the dependent variable is dichotomous; that there is no or very little multicollinearity between independent variables, and that observations are not repeated or matched to manage the possible confounding effect on the outcome. Only variables with a p value of less than 0.05 considered to have a significant relationship with the provision of vaccination for asplenic patients.

4.12 Ethical considerations

To conduct this study at the specified hospitals and health centers, an ethical clearance letter were acquired from Addis Ababa University's Ethical Clearance Committee, College of Health Sciences School of medicine department of surgery ethical review board. Before the interview, each study subject was brief about the aim of this research and they gave oral consent. Participants were assured that their privacy and confidentiality respected during the data collection and that any information that they supplied kept private. During data collection, no personal information about research participants recorded. The questionnaires and data were kept in a secure location to ensure information confidentiality. participation in the study were totally voluntary.

6. Significance of the study

This study is very useful for public health. If Knowledge attitude and utilization of vaccination improved among health care providers who are serving either in tertiary health care institutions or to the level of primary health care asplenic patient will not face resistance from health professionals from getting vaccination, by this the possibility of developing OPSI as well as mortality will be decreased in a significant level.

7. Dissemination of the results

The study's findings will be presented and submitted to the Addis Ababa University School of medicine department of surgery and It will be published and communicated with the relevant stakeholders in the area like ministry of health, Addis Ababa regional health bureau, sub-city health department and administration offices for its implementation.

7. Results and Discussions

7.1. Socio demographic characteristics

Table 1 shows the socio-demographic characteristics of the health care providers who took part in this study. A total of 374 health professionals took part in the study, with a 88.6 percent response rate. Two hundred and thirty five (62.8%) of them were men. One hundred fifty two (40.6%) of them had worked for more than two years. The majority of the responders, 269 (71.3%), worked in hospitals. Respondents were 30.9 years old on average, with a standard deviation of 4.1. In their health care practice 147 (39.5%) obtained on-the-job training, with only 17 people (11.1%) said that they were trained about vaccination for asplenic patient (Table 2).

Table3. Socio demographic characteristics of health care providers working in public health facilities of Addis Ababa City Administration, Ethiopia, 2024 (n=374)

Variables	Category	Frequency	Percent
Sex	Male	235	62.8
	Female	139	37.2
Service year	0-2	54	14.4
	3-5	152	40.6
	6-8	91	24.3
	>=9	77	20.6
Work facility	Health center	105	28.1
	Hospital	269	71.9
Profession	Nurse	177	47.3
	Midwife	57	15.2
	Health officer	18	4.8
	GP	21	5.6
	Resident physician	101	27
School of Study	Government	317	84.8
	Private	57	15.

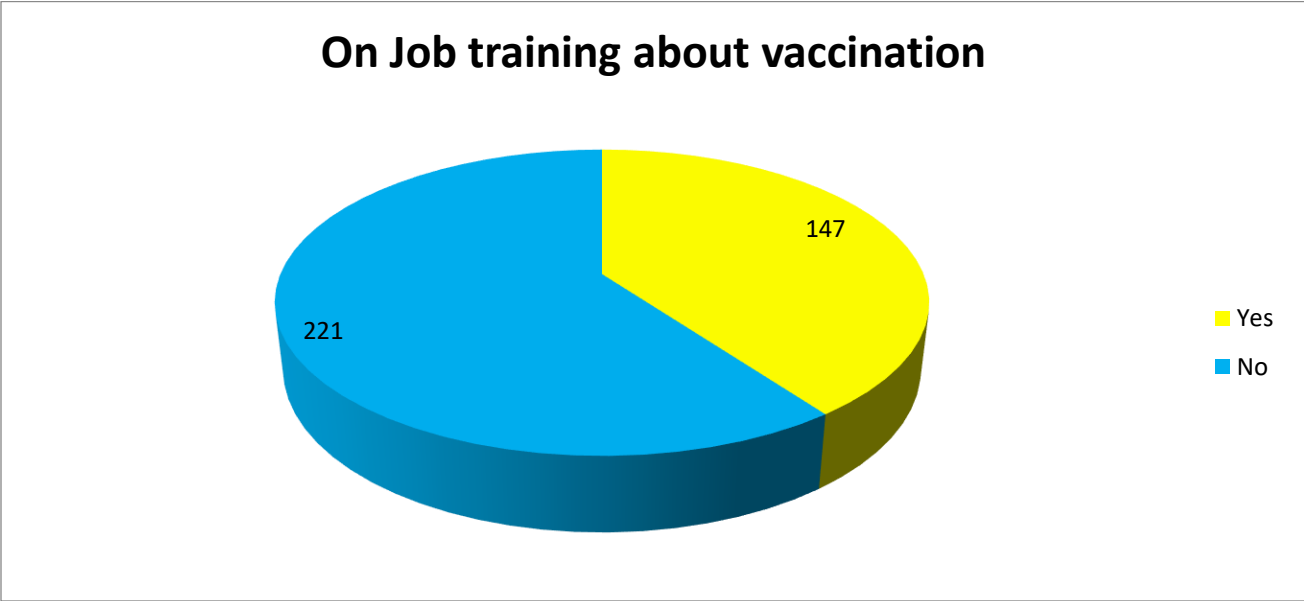


Figure2. Pie chart showing on job training for health care professionals during their health care practice

Majority of the respondents sixty percent didn't get any training about vaccination,

Knowledge of health care workers about vaccination for asplenic patients

Table 3 shows the various knowledge components as well as the overall score for participants' knowledge about vaccination for asplenic or potentially to be asplenic patients. The aggregate knowledge of the participants was 451 (45.1%), indicating that they knew a little about vaccination for asplenic patients. In addition, only 4.3 percent of participants were familiar with the dose of the vaccine. 63.3 percent of the study participants know about the need for vaccination for asplenic patients, preferred vaccine were known by forty seven percent of the participants.

Table4. knowledge of vaccination for asplenic patient among health care providers working in selected public health facilities of Addis Ababa

Variables	Response	Frequency	%
Do you know post splenectomy patient susceptible to infection	Yes	308	82.4
	No	66	17.6
which group of infectious agent are	Encapsulated Bacteria	216	57.8

the most common cause of OPSI	Non capsulated bacteria	38	10.2
	I don't Know	120	32.0
Do you know post splenectomy patient needs vaccination	Yes	238	63.6
	No	56	14.9
	I don't know	80	21.4
At which time vaccination recommended for asplenic or potential to be asplenic patients	At least 2 week prior to splenectomy	179	47.9
	After surgical removal of the spleen	54	14.4
	I don't know	141	37.7
Preferred vaccine for post splenic patients	23 valent polysaccharide vaccine	120	32.3
	7 valent protein conjugated vaccine	53	14.3
	I don't know	199	53.5
Is there a need for revaccination for asplenic patients	Yes	223	59.9
	No	149	40.1
Time of revaccination according to American CDC	After 3 year	73	20.4
	At 6 year	61	17.0
	I don't know	224	62.6
The dose of vaccination for asplenic patients	The same as pediatrics dose	16	4.3
	Double of the pediatrics dose	26	12.3
	I don't know	312	83.4
Which asplenic patients are more susceptible for OPSI	Children < 5 years	31	8.3
	Immunosuppressed individuals	86	23.2
	Both are susceptible	255	68.6
Peak time for the development of OPSI	1-3 years post splenectomy	65	17.6
	At any time post splenectomy	132	35.7
	I don't know	173	46.8

Attitude of health care providers about vaccination for post splenectomy patients

Table 5 presents the various dimensions and overall scores of participants' attitudes toward vaccination for asplenic patients. The study revealed that a majority of healthcare providers (68.2%) agreed on the importance of providing vaccinations for asplenic patients, while 8% of respondents disagreed. Additionally, 266 participants (71.2%) supported the statement that vaccinating asplenic patients helps prevent severe infections. Furthermore, approximately 59% of respondents believed that administering vaccinations at least two weeks prior to splenectomy plays a crucial role in preventing overwhelming post-splenectomy infection (OPSI). However, about 30% of the participants remained neutral on whether vaccinations should be given two weeks before splenectomy.

Table 5. Attitude of health care providers about giving vaccination for asplenic or patients who are working in selected public health facilities of Addis Ababa City Administration, Ethiopia, 2024. (n=374)

Attitude variables		Frequency	Percent
Vaccination should be given for asplenic patient	1. Strongly agree	76	20.3
	2. Agree	179	47.9
	3. Neutral	88	23.5
	4. Disagree	27	7.2
	5. Strongly disagree	4	1.1
vaccination of asplenic patient important to prevent life-threatening infection	1. Strongly agree	101	27.0
	2. Agree	165	44.1
	3. Neutral	71	18.9
	4. Disagree	37	9.9
	5. Strongly disagree	0	0
Vaccinating asplenic patient can reduce OPSI as well as deaths; Do you Agree?	1. Strongly agree	64	17.1
	2. Agree	171	45.2
	3. Neutral	102	25.3
	4. Disagree	33	8.8
	5. Strongly disagree	4	1.1
Vaccination should be given for	1. Strongly agree	29	7.8

children's only; do you agree?	2. Agree	45	12.0
	3. Neutral	48	12.8
	4. Disagree	188	50.3
	5. Strongly disagree	64	17.1
	<hr/>		
Vaccinating adult asplenic patient is ineffective; do you agree?	1. Strongly agree	22	5.8
	2. Agree	32	8.6
	3. Neutral	98	26.2
	4. Disagree	161	43.1
	5. Strongly disagree	61	16.4

Table6. Knowledge of the study participants about vaccination for post splenectomy of potential to be asplenic patients by their profession

Variables	Response	Nurse	Midwife	Health Officer	GP	Resident physician
Post splenectomy patient susceptible to infection	Yes (%)	133 (75)	41(72)	18 (100)	19(90)	97(96)
	No (%)	44 (25)	16(28)	0	2 (10)	4 (4)
	Total	177	57	18	21	101
Post splenectomy patient needs vaccination	Yes (%)	81(45.7)	24(42.1)	18(100)	21(100)	94(93.1)
	No (%)	96(54.3)	33(57.9)	0	0	7 (6.9)
	Total	177	57	18	21	101
Is Booster dose recommended for asplenic patient	Yes (%)	106(60.1)	26(45.6)	10(55.6)	13(61.9)	68(67.3)
	No (%)	69(39.9)	31(54.4)	8(44.4)	8(38.1)	33(32.7)
	Total	175	57	18	21	101

Among the respondents ninety six percent of resident physicians know about the susceptibility asplenic patient for infection followed by 90% general practitioner, least knowledge recorded from midwife only 72 percent of them know about susceptibility asplenic patient for infection. Over all knowledge of the study participant about the need of booster dose of immunization for asplenic was medium to low which was 67.3, 61.9, 55.5 60.1 and 45.6 percent of resident physicians, general practitioners, health officers, nurses and midwife know the need for booster dose of vaccination respectively.

Table7. Knowledge of the study participants about vaccination for post splenectomy of potential to be asplenic patients by their institutions

	Response	Health center	Hospital
Post splenectomy patient susceptible to infection	Yes (%)	82(78.1)	226(84)
	No (%)	23(21.9)	43(16)
	Total	105	269
Post splenectomy patient needs vaccination	Yes (%)	57(54.3)	181(67.3)
	No (%)	48(45.7)	88(32.7)
	Total	105	269
Is Booster dose recommended for asplenic patient	Yes (%)	63 (60)	160(59.9)
	No (%)	42(40)	107(40.1)
	Total	105	267

Utilization of vaccination for asplenic patients

Among 374 respondents only fifty four (14.4percent) of them either prescribe or gave vaccination for asplenic or potentially to be asplenic patients

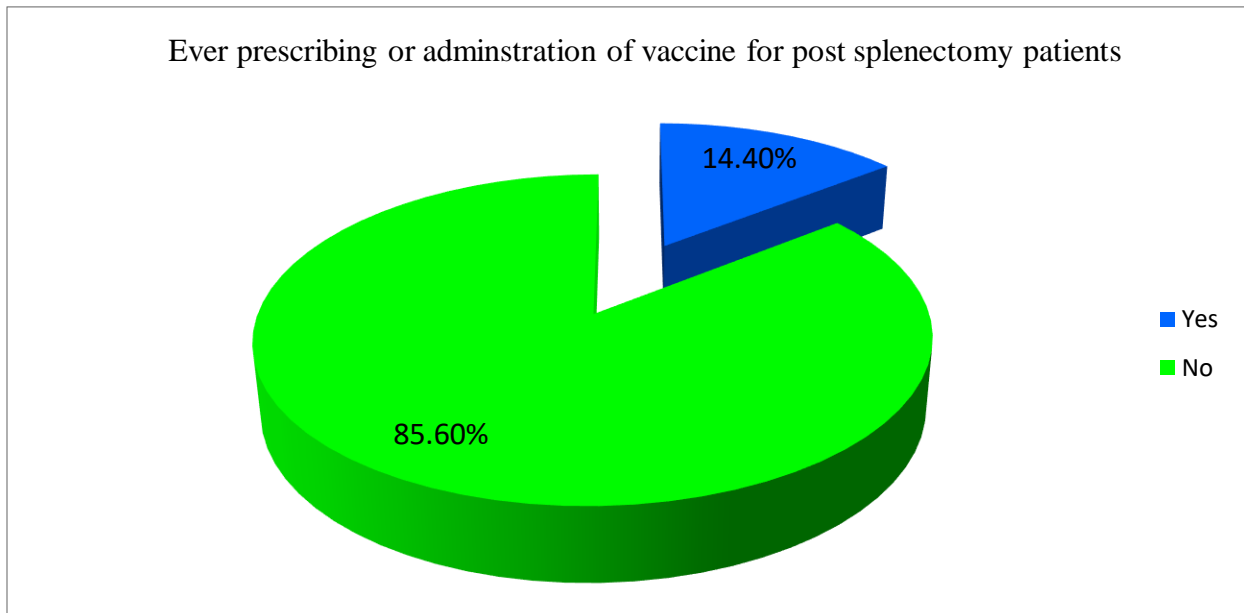


Figure3. shows utilization of vaccination either prescribing or gave vaccine for asplenic patients

Reason which was stated by the respondents for not giving vaccination for asplenic patients

Of 324 respondents more than half of them have no knowledge about the use of vaccination for asplenic patients and five percent of the respondents think vaccinating asplenic patient is not important 40 percent of the respondent they didn't encounter asplenic patient shown below on the table.

Table8. Reason for not utilization of vaccination for asplenic patients by health care providers who are working in selected health institution of Addis Ababa in 2024

Variables	Response	Frequency	Percent
Why don't prescribe or gave vaccine for asplenic patients	I don't encounter asplenic patient	128	39.5
	I think it is not important to give vaccine for asplenic patients	16	4.9
	I don't have adequate information about vaccination for asplenic patients	180	55.6

Table9. Knowledge of the study participants about vaccination for asplenic patients and associated factors

Variables	Character	Good knowledge	Low knowledge	COR (95%CI)	AOR (95%CI)	P value
Sex (366)	Male	124	107	1		
	Female	37	98	0.32 (0.21-0.52)	0.95 (0.19-4.19)	0.95
Institution	Hospital	128	133	1		
	Health center	33	72	0.47(0.29-0.77)	1.12(0.29-4.27)	0.859
Profession	Nurse	40	133	1		
	Midwife	10	47	0.71(0.33-1.52)		0.377
	Health officer	12	6	6.65(2.35-18.84)		0.000*
	GP	17	4	14.13(4.49-44.41)		0.000*
	Resident physician	82	15	18.18(9.45-34.96)		0.000*
Experience	0-2 year	39	13	1		
	3-5 year	82	70	0.39(0.19-0.78)	0.09(0.01-0.83)	0.034*
	6-8 year	22	65	0.11(0.05-0.24)	0.19(0.02-1.94)	0.164

	>=9 years	57	18	0.11(0.04-0.234	0.03(0.002-0.43)	0.010*
School of G	Private	17	40	1		
	Government	144	165	0.07(0.002-2.62)		0.153

Knowledge

In the bivariate analysis of the variables associated with knowledge about vaccination for asplenic patients, several variables showed significant associations. The analysis involved a total of 5 variables: **Sex, Institution, Profession, Experience, and School of Graduation**. Among these, 4 of the variables were found to have statistically significant associations with knowledge. Health officers, general practitioners (GPs), and resident physicians demonstrated significantly higher odds of having good knowledge compared to nurses. Specifically, health officers were 6.65 times more likely to possess good knowledge (AOR = 6.65; 95% CI: 2.35–18.84; $p < 0.001$), while GPs had even higher odds, being 14.13 times more likely to have good knowledge (AOR = 14.13; 95% CI: 4.49–44.41; $p < 0.001$). Resident physicians exhibited the highest likelihood, being 18.18 times more likely to have good knowledge compared to nurses (AOR = 18.18; 95% CI: 9.45–34.96; $p < 0.001$).

In terms of experience, participants with 3–5 years of experience were significantly less likely to have good knowledge compared to those with 0–2 years (AOR = 0.09; 95% CI: 0.01–0.83; $p = 0.034$). Likewise, those with ≥ 9 years of experience had the lowest likelihood of good knowledge (AOR = 0.03; 95% CI: 0.002–0.43; $p = 0.010$).

Table10. Attitude of the study participants about vaccination for asplenic patients and associated factors

Variables	Character	Good Attitude	Bad Attitude	COR (95%CI)	AOR (95%CI)	P value
Sex (366)	Male	173	62	1		
	Female	83	56	0.53(0.34-0.83)	0.42(0.14-1.16)	0.097
Institution	Hospital	189	80	1		
	Health center	67	38	0.75(0.46-1.20)	1.39(0.53-3.66)	0.502

Profession	Nurse	109	68	1		
	Midwife	29	28	0.64(0.35-1.17)		0.154
	Health officer	10	8	0.78(0.29-2.07)		0.618
	GP	19	2	5.92(1.34-26.25)		0.019*
	Resident physician	89	12	4.62(2.35-9.08)		0.000*
Experience	0-2 year	46	8	1		
	3-5 year	115	37	0.54(0.23-1.24)	0.03(0.003-0.24)	0.001*
	6-8 year	43	48	0.16(0.66-0.37)	0.05(0.06-0.465)	0.008*
	>=9 years	25	52	0.36(0.15-0.88)	0.083(0.102-0.68)	0.020*
School of G	Private	32	57	1		
	Government	224	93	1.88(1.05-3.34)	1.34 (0.25-0.71)	0.019

Key: *Statistically significant in multivariable association, AOR=adjusted odds ratio, COR= crude odds ratio, CI= 95 % confidence interval

Attitude

In the bivariate analysis of the variables associated with attitude, several variables showed significant associations. The analysis involved a total of 5 variables: **Sex, Institution, Profession, Experience, and School of Graduation**. Among these, 2 variables were found to have statistically significant associations with good attitude. which are **Profession** and **School of Graduation**.

General practitioners (GPs) and resident physicians exhibited significantly higher odds of having a good attitude compared to nurses. GPs were 5.92 times more likely to have a good attitude (AOR = 5.92; 95% CI: 1.34–26.25; p = 0.019), while resident physicians were 4.62 times more likely to have a good attitude (AOR = 4.62; 95% CI: 2.35–9.08; p < 0.001).

Regarding experience, participants with 3–5 years of experience were significantly less likely to have a good attitude compared to those with 0–2 years of experience (AOR = 0.03; 95% CI: 0.003–0.24; p = 0.001). Similarly, those with 6–8 years of experience had lower odds of a good attitude (AOR = 0.05; 95% CI: 0.06–0.465; p = 0.008), as did those with ≥9 years of experience (AOR = 0.083; 95% CI: 0.102–0.68; p = 0.020).

Graduates from government schools were also more likely to have a good attitude compared to those from private schools (AOR = 1.34; 95% CI: 0.25–0.71; p = 0.019).

Table11: Factor influencing vaccine utilization for asplenic or potentially to be asplenic patients among health care providers in public health facilities of Addis Ababa City Administration, Ethiopia, 2024 (n=374).

Variables	Character	Utilization of vaccine		COR (95%CI)	AOR (95%CI)	P value
		Yes	No			
Sex (366)	Male	38	197	1		
	Female	16	127	0.67(0.36-1.26)	0.04(0.01-1.96)	0.104
Institution	Hospital	41	228	1		
	Health center	13	92	0.786(0.40-1.53)	4.23(0.53-3.66)	0.318
Knowledge On vaccination	Bad	7	198	1		
	Good	43	118	10.3(4.49-23.66)	6.86(2.56-18.32)	0.000*
Profession	Nurse	24	153	1		
	Midwife	2	55		0.80(0.11-6.11)	0.832
	Health officer	4	14		1.72(0.28-10.50)	0.554
	GP	4	17		2.37 (0.37-15.05)	0.925
	Resident physician	20	81		0.45(0.12-1.699)	0.237
Experience	0-2 year	12	42	1		
	3-5 year	23	129	0.54(0.23-1.24)	0.68(0.267-1.74)	0.424
	6-8 year	2	89	0.16(0.66-0.37)	1	
	>=9 years	17	60	0.36(0.15-0.88)	1.17(0.212-6.490)	0.854
School of G	Private	10	47	1		
	Government	44	54	1.88(1.05-3.34)	1.19 (0.25-5.61)	0.827

Key: *Statistically significant in multivariable association, AOR=adjusted odds ratio, COR= crude odds ratio, CI= 95 % confidence interval

The bivariate analysis revealed no significant associations between knowledge, experience, Institution Type, Profession and school of graduation with vaccine utilization. However, in the

multivariable analysis, **knowledge on vaccination** statistically significant, indicating it as the strongest predictor of vaccine utilization when controlling for other factors (AOR = 6.86, 95% CI: 2.56–18.32, $p < 0.001$).

5. Strengths and limitations of the study

5.1. Strengths

The research considers being the 1st which determines knowledge attitude and utilization of vaccination for asplenic patient in Ethiopia, so it will serve as the starting point for further research

5.2. Limitations

The study was Cross-sectional and study area selected conveniently so it might not generalized to the whole health care providers.

Conclusion

This study revealed that majority of health care providers didn't have adequate knowledge about vaccination for asplenic or potentially to be asplenic patients with the level of knowledge of 45.1% both in the hospital and health center setting due to this utilization of vaccination is also low so it is better to create awareness about the consequence of splenectomy among all health care providers.

Annex 1.

Questionnaire

Addis Ababa University

College of health sciences school of medicine department of surgery

Greetings, responder My Name is Dr Tesfamichael Bizuayehu, and I am a fourth -year general surgery resident at Addis Ababa University. I am currently conducting a survey of health care providers' knowledge, attitudes and provision of vaccination for asplenic patients and related factors in Addis Ababa.

Participating in this study can assist the researchers in determining the participant's knowledge and attitude and practice of vaccination for asplenic patients. The data will be used to improve the service of vaccination for asplenic patients.

There will be no cost or payment for participation in this research. This questionnaire could take up to 20 minutes to complete. Participating in the study carries no risk for the participants.

I want to reassure you that your privacy will be respected at all times. It is not necessary to include your name or roll number on the format. It is entirely your choice whether to engage or not to engage in the study. If there is anything that needs to be clarified, please do not hesitate to ask question the facilitator.

Do you want to take part in the research?

1. Yes 2. No

I would like to get some basic information about back ground in formations?

Part A: Socio demographic		
No	Questions	
101.	What is the gender of the respondent?	<ol style="list-style-type: none"> 1. Female 2. Male
102	How old are you	Age in ____ ____ completed years
103	what is your profession? []	<ol style="list-style-type: none"> 1. Nurse 2. Midwife 3. Health officer 4. General practitioner 5. Resident
104	In which department you are serving now	<ol style="list-style-type: none"> 1. EPI department 2. Internal medicine 3. Surgical department 4. Pediatrics and child health
105.	From where did you graduate?	<ol style="list-style-type: none"> 1. Private 2. Government
106	Year of experience	(Year and month) Year ____ month____
107	Did you receive on job training in the last one year? [Hint: On-job training]	<ol style="list-style-type: none"> 1. Yes 1 2. No 0.....skip to 201
108	Did the training includes immunization for asplenic patients	<ol style="list-style-type: none"> 1. Yes 2. No
Part B Attitude of the care providers on immunization of asplenic patients		
201.	Some care provider wants to give vaccine for asplenic patient; Do you agree?	<ol style="list-style-type: none"> 6. Strongly agree 7. Agree 8. Neutral 9. Disagree

		10. Strongly disagree
202.	Some care providers say vaccination of asplenic patient important to prevent life-threatening infection	6. Strongly agree 7. Agree 8. Neutral 9. Disagree 10. Strongly disagree
203.	Some care providers say all available vaccine should be given to all asplenic patients; do you agree?	1. Strongly agree 2. Agree 3. Neutral 4. Disagree 5. Strongly disagree
204.	Some care providers say vaccinating asplenic patient can reduce OPSI as well as deaths; Do you Agree?	6. Strongly agree 7. Agree 8. Neutral 9. Disagree 10. Strongly disagree
205.	Some care providers says giving vaccine for patients plan to have splenectomy 2 weeks before surgery is necessary; Do you agree?	1. Strongly agree 2. Agree 3. Neutral 4. Disagree 5. Strongly disagree
206.	Some care providers say not all asplenic patients need vaccination; do you agree?	1. Strongly agree 2. Agree 3. Neutral 4. Disagree 5. Strongly disagree
207	Some care providers wish to give vaccination for asplenic patient routinely; Do you agree	1. Strongly agree 2. Agree 3. Neutral 4. Disagree 5. Strongly disagree

208.	Some care providers says vaccination should be given for children's only; do you agree?	6. Strongly agree 7. Agree 8. Neutral 9. Disagree 10. Strongly disagree
209.	Some care providers say giving vaccination for asplenic patients should be requested by physicians; do you agree?	1. Strongly agree 2. Agree 3. Neutral 4. Disagree 5. Strongly disagree
210.	Some care providers say vaccination for asplenic patient is ineffective; do you agree?	1. Strongly agree 2. Agree 3. Neutral 4. Disagree 5. Strongly disagree

Part C: Knowledge of the care providers

301	Where the spleen is found in our abdomen	1. Left upper quadranrt of the abdomen 2. right upper quadrant of the abdomen
302	Do you know spleen involved in the immune system	1. yes 2. No
303	Have you ever heard about post splenectomy or hyposplenic patients	1. yes 2. No
304	Do you know the cause of splenectomy	1. yes 2. No
305	If the answer for the above question yes state what you knows	1..... 2..... 3..... 4.....
306	Do you know post splenectomy patient are susceptible for infection	1. yes 2. No
307	Do you know post splenectomy patient need	1. yes

	to be vaccinated	<ol style="list-style-type: none"> 2. No 3. I don't know
308	Which group of infectious agent are the most common cause of Overwhelming post splenectomy sepsis	<ol style="list-style-type: none"> 1. encapsulated bacteria 2. Non encapsulated bacteria 3. I don't know
309	Which vaccine recommended for post splenectomy patients	<ol style="list-style-type: none"> 1. hemophilus influenza type b 2. pneumococcal vaccination 3. both are recommended 4. I don't know
310	At which time vaccination recommended for elective splenectomy patients?	<ol style="list-style-type: none"> 1. 2 weeks before splenectomy 2. after the surgical removal of the spleen 3. I don't know
311	Is Vaccination safe and effective if given for asplenic patients	<ol style="list-style-type: none"> 1. yes 2. No 3. I don't know
312	Which vaccine preferred for post splenectomy patient	<ol style="list-style-type: none"> 1. 23-valent polysaccharide conjugated pneumococcal vaccine 2. 7-valent protein-conjugated pneumococcal vaccine 3. I don't know the exact vaccine
313	Is there a need for revaccination for post splenectomy patients	<ol style="list-style-type: none"> 1. yes 2. No
314	For the above answer is yes according to American CDC and recommended year is	<ol style="list-style-type: none"> 1. every 3 year 2. every 6 years 3. I don't know the exact time
315	The dose of vaccination for asplenic adult patient	<ol style="list-style-type: none"> 1. The same as pediatric dose 2. two times to the pediatrics dose 3. I don't know the exact dose of vaccination
316	Which asplenic patient most susceptible for	<ol style="list-style-type: none"> 1. Children < 5 years of age

	overwhelming post splenectomy sepsis	<ol style="list-style-type: none"> 2. Immunosuppressed adults 3. Both are susceptible
317	Peak time for development of overwhelming post splenectomy sepsis	<ol style="list-style-type: none"> 1. 1-3 years post splenectomy 2. At any time post splenectomy 3. I don't know the exact time
318	Is Antibiotic prophylaxis indicated for asplenic patients	<ol style="list-style-type: none"> 1. Yes 2. No 3. I don't know
319	Is asplenic patient recommended to have on hand antibiotics if the answer is yes go to Q 320	<ol style="list-style-type: none"> 1. Yes 2. No 3. I don't know
320	Which antibiotic is recommended to take while asplenic patient develop fever	<ol style="list-style-type: none"> 1. Doxycycline 2. Amoxicillin with clavulanic acid 3. Ciprofloxacin 4. I don't know
Provision or prescribing vaccination for asplenic patients		
401	Had you ever prescribe or gave vaccination for asplenic patient	<ol style="list-style-type: none"> 1. yes 2. No
402	If not why	<ol style="list-style-type: none"> 1. I didn't encounter asplenic patient 2. I think it is not important to vaccinate Asplenic patient 3. I don't have adequate information about the use of vaccination for adult without spleen

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