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Knowledge, Attitudes and Perception of Some Selected Communities in Kaduna State towards Emerging Viral Zoonoses

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ABSTRACT
A cross-sectional study was conducted at Sabon-Birni and its sub-communities in Igabi Local Government area of Kaduna state to assess the knowledge, attitudes and perception of the communities. A total of 397 randomly selected participants had consented to participate in the study where they were given the translated semi-structured questionnaire orally of which they responded voluntarily. Of the total respondents, 84.4% said that they have heard of Avian Influenza of which only 14.3% of them believed that Avian influenza is a viral and also a zoonotic disease; 24.2% have heard of Monkeypox before in which 30.2% of them believed that is a viral and also a zoonotic disease; all 100% of the respondents have heard of Covid-19 before in which only 35.3% believed that it is a viral and also a zoonotic disease; 94.5% have heard of Yellow fever where 35.5% of them believed that it is a viral and also a zoonotic disease. Also, 72.8% have heard of Lassa haemorrhagic fever before in which 61.2% of them believed that is a viral and also a disease of animal origin. On the other hand, 91.3% of those who have knowledge of Human Influenza perceived the infection as an illness of the nose, a Chi square test was done and P-value of <.0001 was calculated. 38.5% of those who have knowledge of Monkey pox perceived it as an infection that causes swollen of lymph nodes, P-value is .74. Again, 41.1% of respondents that have knowledge of Covid-19 perceived the infection as a disease of respiratory system, P-value is <.0007; while 51.6% of the participants that are knowledgeable about Lassa haemorrhagic fever perceived it as an haemorrhagic disease and can kill the host within 14 days of clinical manifestation, the P-value is .0005. This study reported that 72% of the entire respondents were making contact with Bats of which 79.4% of them were making contact with Bats droppings. Also, 73% of the entire participants were making contact with Rodents where 33.4% of them were catching and using the rodents as source of protein. This study also looked at whether there is significance relationship between educational status of the participants and their attitudes that may favor transmission of zoonotic viruses to humans. A Chi square test was performed to examine the relationship between educational status and making proper personal hygiene after unusual contact with wild animals of which was significant, x2 (1, N=397) = 97.37, P<.05. There is relationship between educational status of the communities and personal hygiene after making contact with wild animals. There is also no significant association (P>0.05) between educational status of the respondents and the forms of contact they were making with wild animals, Therefore, the role of education of the respondents on their attitude towards emerging zoonotic viral diseases transmission prevention, was found to be statistically insignificant; and it is recommended that creation of awareness and training programs against transmission of emerging viral zoonoses, and also on prevention and control of the diseases in these communities; especially targeting people with non-formal education, farmers, fishermen and hunters.

Keywords: Attitudes, Communities, Cross-sectional survey, Emerging viral zoonoses, Knowledge

1. INTRODUCTION

Vertebrate Animals have been an important source of infectious diseases transmissible to humans throughout the history of mankind (Bidaisee, 2013; Crameri, 2014), many of these diseases are caused by viruses and they are referred to as viral zoonoses (Bauerfeind, 2016; Walker et al., 2018). Emerging viral zoonoses are diseases caused by different viruses and many different modes of transmissions from animals to humans (Bidaisee, 2013), they are grouped based on the type of infections produced by them in natural hosts; that is encephalitis/haemorrhagic or local lesions like rash

and arthralgia. The transmission of emerging viral zoonoses sometimes involves arthropods vectors like mosquitoes or ticks and or in direct contact with the infected wild animals (Savic et al., 2014). The four major groups of animals that are possibly transmitting these emerging viral zoonotic infections involves rodents, water/wild/migratory birds, bats and non-human primates (Yashpal, 2020). Some of these diseases are endemic in Africa especially Nigeria, they includes Monkeypox, Lassa haemorrhagic fever, Ebola haemorrhagic fever, severe acute respiratory syndrome and Marburg haemorrhagic fever. Knowledge about emerging viral zoonoses remains low in sub-urban or rural communities in Nigeria especially in its northern parts (Yashpal, 2020). Due to tremendous impact of viruses on shaping the evolution of human, results from their capabilities to hijack energy generating and protein synthesizing machineries of host cells (Wohl & Wu K, 2016), and also to be reasserted and recombined during replication and then to spillover to other species, diseases causes by viruses through animals are posing great challenges on public health and biodefence (Suu-Ire et al., 2021).

Northern Nigeria is highly dependent on its animal population for transport, draught power, fuel, clothing, and protein (meat, eggs, and milk) due to the harsh climate (Walker et al., 2018; Bauerfeind, 2016). Viruses have the capacity to move from ill animals to humans, resulting in the establishment of viral zoonoses; without adequate precautions, this connection poses a huge risk to public health with enormous economic implications (Katze., 2016; Dawit et al., 2013).Direct contact with the animal, vectors (such as fleas or ticks), or contaminated inanimate objects are all potential routes of transmission for zoonotic viruses (Dhiman, 2014).

Different studies conducted so far on animals from different places in Nigeria indicated the occurrence of emerging viral zoonotic diseases. For example, (Anjorin et al, 2017) reported influenza A virus of 1.3% in pigs and 0.005% in pig-handlers. Nigeria Centre for Disease Control, on its weekly epidemiological report volume12 No.19 1st June, 2021; reported six (6) laboratory confirmed monkeypox cases in 2021, thirteen (13) confirmed cases of yellow fever, two hundred and seventy three (273) laboratory confirmed cases of lassa fever and two thousand and seventy one (2071) Covid-19 laboratory confirmed cases.

Like other portions of the sphere, occurrence of viral zoonoses in sub-urban and rural areas are influences by many drivers including ecological changes, global warming and climate change, human demographic changes, human behavioral changes, microbial evolution and adaptation, and public health deficiencies (Yashpal, 2020; Crameri et al., 2014).

Majority of the zoonotic viruses are not DNA but RNA viruses (Dhanasekaran et al., 2015; Bauerfeind, 2016), because during infections the latter does not have proofreading mechanism that would help them to correctly assemble the replicated viral particles; this results to generation of different types of variants of viruses during viral replication (Dhanasekaran et al., 2015). This allows them to spread to additional hosts and adapt to a new environment when they come into contact, leading to a newly developing viral disease; SARS-CoV is a prime example of this process. The public's attention is drawn to the emergence of viral zoonoses, which revitalizes the public health infectious disease research municipal. However, this concern has also led to competition for finance and turf wars between animal health and public health researchers and public officials, which has, in some cases, slowed and delayed progress toward effective prevention, control, and biodefense (Braks et al., 2014).

For instance, the Rift Valley fever virus is a mosquito-borne causative agent of both a febrile illness with hepatitis and hemorrhagic fever in humans and a classic disease in sheep (Braks et al., 2014). It is the origin of one of the most severe zoonotic disease epidemics in Africa (Savic et al., 2014).

Although it is still unknown what natural fruit bat reservoirs the Ebola and Marburg viruses have, which are the most poisonous hemorrhagic fevers, they are zoonotic (Walker et al., 2018). In central Africa, particularly Ghana in 2022, these viruses were to blame for a number of recent and significant outbreaks of Ebola and Marburg hemorrhagic fevers (Crameri and colleagues, 2014).

Although it is extremely doubtful that there will be any means to foresee when or where the next significant new zoonotic viruses will emerge, and although it is also highly unlikely that there will be any way to forecast a new pathogen's eventual importance from its early activity, In order to successfully prevent and control viral zoonoses, cultures and societies that domesticated and bred animals for food and clothing must understand Agent-Host-Environment equilibrium; because viral zoonoses emerge, there is a greater risk that too many epidemiologists will be sitting at their computers instead of being in the field investigating early events that drive prevention and control actions (Braks et al., 2014; Bauerfeind, 2016).

2. MATERIALS AND METHODS

2.1. Description of the Study Area

Study was conducted in Sabon-Birni and four (4) sub-villages involving Kitukuri, Kawara, Baka and Risani, all from Igabi Local Government area of Kaduna State. Sabon-Birni is found at an elevation 591 meters (1939 feet) above sea level in between 10o 48’44” N and 7o 18’8” E. In the summer, between June and September, it receives the bulk of

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its rainfall, while the winters are relatively dry (December to March). There is a distance of 30 kilometers to Rigachikun Kaduna and 18 kilometers to the Kaduna International Airport.
Sabon-Birni bordered with meandering river in the west which flows throughout the year, bordered to Rikau forest reserve in the north and also border to forest in both east and south, bordered to Rigachikun -to-Dogon Dawa Road at East and North as presented in figure 1.

Figure 1: Map of Sabon Birni showing its borders with river, road and forest. https://mapcarta.com/16994052

2.2. Ethical approval
Interview of human beings on the knowledge, attitudes and perception of some selected community of Kaduna state towards viral zoonoses were made in this study. Thus, an introductory letter was obtained from Kaduna Study Center, National Open University of Nigeria and submitted to Head of Village, Sabon-Birni. Informed consent was obtained from the participants. Post interview and advice on safer interactions between domestic animals, wildlife and humans were introduced to participants.

2.3. Study Population
The study was conducted in villages of Kitukuri, Risani, Baka, Kawara and Sabon-Birni. The study covered farmers, hunters, fishermen, drivers, students, male and female who resided in the areas over the past 10 years, involving individuals from age 20 to 70 years both males and females. At Sabon-Birni, there are Silk cotton trees inside a weekly local market where species of egrets (Gray Heron & Cattle egrets) live and having nests on the trees; also Straw-colored fruit Bats are staying there from morning to evening time during dry season and going out for fruits in the night.

2.4. Study Design
A cross-sectional study method was used in August to September 2022 to assess the knowledge, attitudes and perceptions of five selected communities in Kaduna State towards emerging viral zoonoses. This is a type of research design in which data can be collected from many different individuals at a single point in time, the variables are observed without influencing them; this method is preferred because there is no need to manipulate data in the study that was conducted. This study was carried out at Sabon-Birni and its sub-communities in Igabi Local Government area of Kaduna State. It involved all the individuals that were randomly selected from the communities.

2.5. Sample Size Determination
Based on the hypothesis that half of the population has some level of familiarity with and a negative outlook on emerging viral zoonotic diseases, the necessary sample size was calculated. Because the population size of the selected communities is unknown, the sample size was determined by considering the work of (Vetsi *et al.*, 2021) and used the formula given by Cochran: $no=Z2pq/e2$ to determine the sample size for the study, we chose 95% confidence interval, $p = 0.5$, $e = 0.05$ margin of error, and Z value = 1.96
We arrived at 384.16, rounded to 385. Three percent 3% was added to increase precision, the final samples was 397 individuals.

2.6. Study Instrument
A survey Questionnaire partly adapted from similar study conducted by other researcher (Tenzin *et al.*, 2012) was used for this study, each questionnaire consisting closed and few open questions; it consisted of four parts, First part obtained data on socio-demographic characteristics of the participants (Gender, Age group, educational status, marital status, religion, ethnicity and occupation) the second part obtained data on the contacts and forms of contacts between wild animals the respondents, while the third part obtained data on proper personal hygiene after making a contact

with wild animals, reporting to health care sector after unusual contact, and also reporting to health care sector due to unusual experience after making a contact. The fourth part obtained data on knowledge and perceptions (being heard of the disease before, aware of it as viral infection, aware of it as zoonotic disease, and perception of the disease clinical signs) of participants on five selected viral zoonoses i.e. Avian Influenza, Monkeypox, Covid-19, Yellow Fever and Lassa fever.

2.7. Adaptation of the Instrument

The questionnaire was adapted to contain all wild animals that can presently be found in the study areas and are likely associated with viruses, the questionnaire items were also adapted to suite the local context and translated to local language. The questionnaire was divided into three section, First section contain socio-demographic data, second section contain data on attitudes of the population towards zoonotic viral diseases and third section contain data on Knowledge and perception some emerging viral zoonoses.

2.8. Face Validation of the questionnaire (Validity test)

Prior to administer the questionnaire, two doctors were given the questionnaire, the questionnaire was self-administered. Clarity of the content, language and wording used and also the general structure of the questionnaire were taken. Result were discussed among the stakeholders, minor corrections and fine tuning of the questionnaire were address according to their comments and suggestions.

2.9. Reliability Test of the Questionnaire

This was performed first prior to start the real study, a questionnaire containing three parts were sent to thirteen respondents. Contact with wild animals contained eight (8) questions (α=0.93), attitudes towards emerging viral zoonoses contained three (3) questions (α=0.89), and knowledge regarding some viral zoonoses contained twenty six (19) questions (α=0.91), the overall questions were 30 in numbers (α=0.96). This result was good >.6, and and it was concluded that all items in our survey were internally consistent and reliable to assess the knowledge, attitude and perception of some selected communities in Kaduna state. This calculation was carried out using Wessa P. (2021), Cronbach alpha (v1.0.6) in Free Statistics Software (v1.2.1), Office for Research Development and Education, URL https://www.wessa.net/rwasp_cronbach.wasp

2.10. Sampling Technique

The questionnaire were first developed in English, based on the work of (Hiko et al., 2018), and then translated in to the local language (Hausa language) for appropriateness and easiness in approaching the study participants. By considering the work of Usuwa et al., 2020, four trained under graduates that have knowledgeable about the study areas help in administering the questionnaire by interviewing individuals.

2.11. Method of Data collection

By considering the work of Fesseha *et al.* 2020, A questionnaire was distributed at each of the five sites to individuals who met the inclusion criteria (availability, informed consent, and willingness to participate). Each respondent was interviewed for a mean of 10 minutes. Participants' age, gender, marital status, ethnicity, education level, and occupation, as well as their level of knowledge about and perspective on viral zoonoses, can be gauged through the survey's questions.

2.12. Method of Data Analysis

The data was collected, coded and entered into a spread Excel 2013 spreadsheet application program, Vassar stats and Quantpsy; Percentages were also calculated. Multivariate analyses were performed using Chi square (x2) test to compare responses to questions related to the knowledge, attitudes and perception of emerging viral zoonoses from the respondents of Sabon-Birni and the sub-communities in Igabi L.G.A of Kaduna State. Results were considered statistically significant if they had a 95% confidence interval (CI) and a p-value (probability value) of less than 0.05.

3.0. RESULTS

3.1. Socio-demographic status of Participants

A total of 397 respondents were involved in this study, comprising few number (15.6%) of women and more (84.4%) of men. Only 5.3% of the participants have gone tertiary institutions while 20.4% have only gone for non-formal education. About 33.8% were between the ages of 20-29 years while 5.8% were between 60-69 years. All the respondents were reported to be Muslims (100%) of which 99.5% were Hausa speakers and 0.5% were Fulani tribes. Also, 69.8% of the respondents were farmers, 7.1% fishermen followed by 6.1% of the participants as hunters. Farmers composes 69.8% of the participants followed by students with 11.2%. As shown in Figure 2 and 3, and Table 1.

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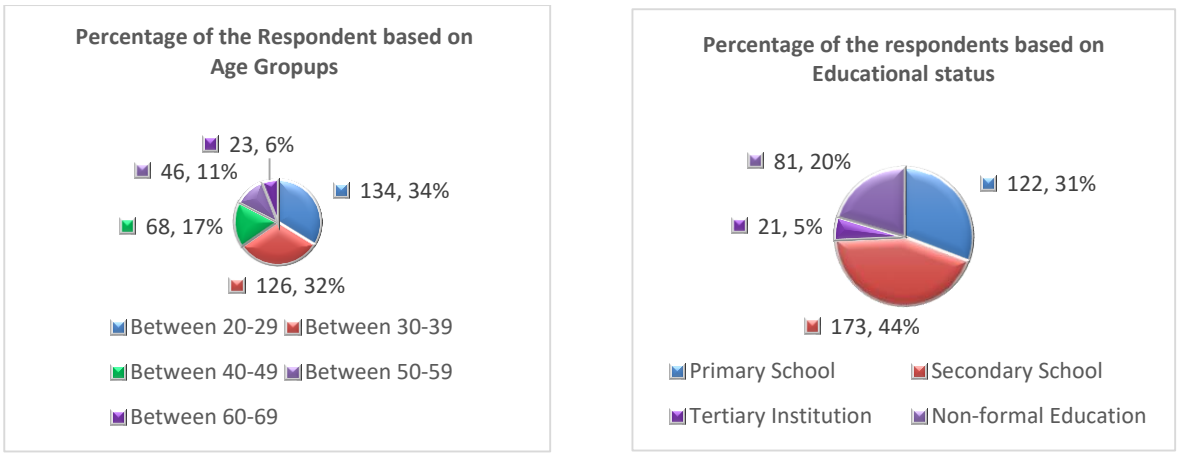

Figure 2: Pie Chart showing Age groups and educational status of the studied communities of Sabon-Birni, Igabi Local Government area of Kaduna State

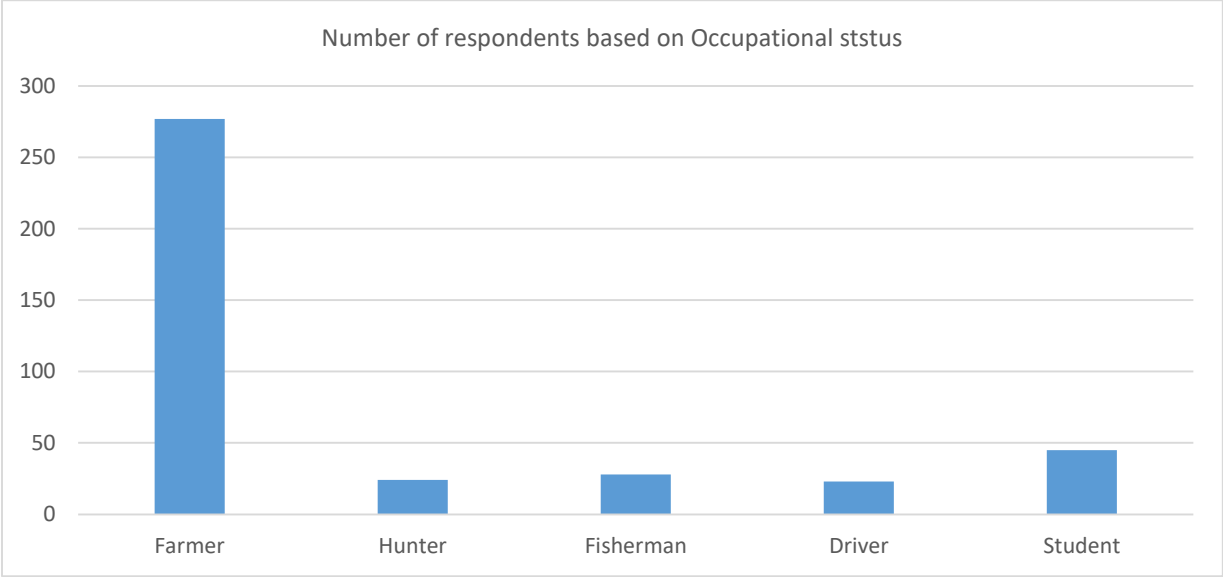

Figure 3: Chat showing the distributions of the respondents based on occupational status

3.2. Knowledge of the communities on five categories of viral zoonoses

Majority (84.4%) of the participants have heard of Avian Influenza of which small portion (20.2%) of the communities were knowledgeable of Avian Influenza as a viral infection, while few (14.3%) of them were aware that it is a viral zoonotic infection transmitted from wild/water birds to humans. But, haven heard of monkeypox is in the minority (24.2%) of people in the communities and 30.2% of those who have heard about the disease believed that it is a viral disease and can be transmitted from rodents to human. Similarly, Lassa haemorrhagic fever is been heard about by 72.8% of the respondents, among them, 61% believed that it is a viral and also zoonotic disease of public health importance as presented in Table 2.

Table 1: Socio-demographic characteristics of the participants in the study area

Variables		Frequencies	Percentages (%)
Sex	Male	335	84.4
	Female	62	15.6
Age groups	Between 20-29	134	33.8
	Between 30-39	126	31.7
	Between 40-49	68	17.1
	Between 50-59	46	11.6

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	Between 60-69	23	5.9
Marital Status	Single	108	27.2
	Married	289	72.8
Educational Status	Primary School	122	30.7
	Secondary School	173	43.6
	Tertiary Institution	21	5.3
	Non-formal Education	81	20.4
Occupation	Farmer	277	69.8
	Hunter	24	6.1
	Fisherman	28	7.1
	Driver	23	5.8
	Student	45	11.3
Religion	Muslim	397	100
Ethnicity	Hausa	395	99.5
	Fulani	2	.5

Table 2: Knowledge and perception of the communities on some categories of viral zoonotic diseases

Viruses	Viral Zoonoses categories	No. (%) of people heard about it (N=397)	No. (%) Believed that it is a Viral & Zoonotic disease
Influenza Virus	Avian Influenza	335 (84.4)	48 (14.3)
Monkeypox Virus	Monkeypox	96 (24.2)	29 (30.2)
SARS-CoV-2	Covid-19	397 (100)	140 (35.3)
Yellow Fever Virus	Jaundice	375 (94.5)	140 (35.4)
Lassa Fever Virus	Lassa Haemorrhagic Fever	289 (72.8)	177 (61.2)

3.3 Perception of the Communities on the selected viral zoonoses based on educational status of the participants

The report from Table 3 indicated that perception of Avian Influenza was higher with about 40% among those who have attended secondary school than that of the remaining educational levels, while the knowledge of Influenza is higher (35.4%) among the participants that goes to tertiary institutions, it is lower (10.4%) in the respondents that went for non-formal education; this shows that there is significance association $p<0.05$ between educational status of the participants and the way they perceived avian influenza as one of the emerging viral zoonoses. Apparently, monkeypox was perceived higher with about 42% and also known more 34.5% in respondents that have attended tertiary institutions than other educational levels. However, there is no significance association between educational status of the participants and their knowledge and perceptions towards monkeypox, covid-19 and yellow fever; but it existed in between perception and knowledge of lassa haemorrhagic fever and educational levels of the respondents.

Table 3: Perceptions of the communities regarding some emerging viral zoonotic diseases with respect to their educational status

Name of Diseases	Perception on the selected zoonotic viral diseases	Non-formal education N (%)	Primary School N (%)	Secondary School N (%)	Tertiary Institution N (%)	Total (%)
Avian Influenza	Believed to be transmitted from wild/water Birds to Humans	5 (10.4)	12 (25.0)	14 (29.2)	17 (35.4)	48 (14.3)
	It is an illness of the nose, does not affect other systems of the body	57 (18.6)	109 (35.6)	124 (40.5)	16 (5.2)	306 (91.3)

Monkeypox	Believed that it can be transmitted from Rodents to human	5 (17.2)	6 (20.7)	7 (24.1)	10 (34.5)	28 (29.2)
	It causes swollen of Lymph nodes which differentiate it from smallpox	7 (21.2)	8 (24.2)	8 (24.2)	14 (42.4)	37 (38.5)
Covid-19	Believed that it can be transmitted from Bats to Humans	28 (20.0)	47 (33.6)	51 (36.4)	14 (10.0)	140 (35.3)
	It is a Disease of Respiratory systems	7 (4.3)	62 (38)	84 (52)	10 (6.1)	163 (41.1)
Yellow Fever	Believed that it can be transmitted from Monkeys to Human through Mosquitoes bites	28 (20.0)	47 (33.6)	51 (36.4)	14 (10.0)	140 (37.3)
	It is called Jaundice and if in severe, the patient may die in 10 days	21 (13.1)	61 (38.1)	59 (36.9)	19 (11.9)	160 (42.7)
Lassa Haemorrhagic Fever	Believed that it can be transmitted from Rodents	22 (12.4)	67 (37.9)	71 (40.1)	17 (9.6)	177 (61.2)
	It is haemorrhagic and can kill within 14 days	5 (3.4)	77 (51.7)	52 (34.9)	15 (10.1)	149 (51.6)

Hypothesis on the association between educational status of the communities and the way they perceived the selected viral zoonoses

There is likely a significant association P<0.05 between educational status of the participants and the way they perceived Avian influenza and Lassa haemorrhagic fever as zoonotic viral infections; therefore, null hypothesis is rejected. However, there is no significant association P>0.05 between their educational status and the way they perceived Yellow fever, Monkeypox and Covid-19 as viral zoonoses.

Name of Diseases	**Perception on the selected zoonotic viral diseases**	**Non-formal education N (%)**	**Primary School N (%)**	**Secondary School N (%)**	**Tertiary Institution N (%)**	**Chi Square (x^2)**	**P-value**
Avian Influenza	Believed to be transmitted from wild/water Birds to Humans	5 (10.4)	12 (25.0)	14 (29.2)	17 (35.4)	44.9	<.0001
	It is an illness of the nose, does not affect other systems of the body	57 (18.6)	109 (35.6)	124 (40.5)	16 (5.2)		
Monkeypox	Believed that it can be transmitted from Rodents to human	5 (17.2)	6 (20.7)	7 (24.1)	10 (34.5)	0.11	.74.
	It causes swollen of Lymph nodes which	7 (21.2)	8 (24.2)	8 (24.2)	14 (42.4)		

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	differentiate it from smallpox						
Covid-19	Believed that it can be transmitted from Bats to Humans	28 (20.0)	47 (33.6)	51 (36.4)	14 (10.0)	21.8	<.0007
	It is a Disease of Respiratory systems	7 (4.3)	62 (38)	84 (52)	10 (6.1)		
Yellow Fever	Believed that it can be transmitted from Monkeys to Human through Mosquitoes bites	28 (20.0)	47 (33.6)	51 (36.4)	14 (10.0)	2.83	.09
	It is called Jaundice and if in severe, the patient may die in 10 days	21 (13.1)	61 (38.1)	59 (36.9)	19 (11.9)		
Lassa Haemorrhagic Fever	Believed that it can be transmitted from Rodents	22 (12.4)	67 (37.9)	71 (40.1)	17 (9.6)	12.14	.0005
	It is haemorrhagic and can kill within 14 days	5 (3.4)	77 (51.7)	52 (34.9)	15 (10.1)		

3.4. Forms of contact that exists between wild animals and the people of entire communities that may favor the transmission of zoonotic viruses

Table 4 shows the form of contact that exists between the entire communities and wild animals that may favor the transmission of zoonotic viruses from wild animals to humans; the table shows that 68.3% of the participants were making contact with wild/water Birds, 72% were making contact with Bats, 73% were making contact with Rodents while 12.1% makes contact with Monkeys. This indicated that they were positively pushing themselves to the brink of viral spillover.

Table 4: Form of contact that exists between wild animals and the communities

Contact with Wild animals	**Responses**	Non-formal education	Primary School	Secondary School	Tertiary Institution	Total (%)
Making contact with Bats	YES	71 (24.)	99 (34.6)	103 (36.0)	13 (4.5)	286 (72)
	NO	10 (9.0)	23 (20.7)	70 (63.1)	8 (7.2)	111 (28)
Making contact with Wild/water Birds	YES	67 (24.7)	93 (34.3)	99 (36.5)	12 (4.4)	271 (68.3)
	NO	14 (11.1)	29 (23.0)	74 (58.7)	9 (7.1)	126 (31.7)
Making contact with Rodents	YES	73 (25.2)	97 (33.4)	108 (37.2)	12 (4.1)	290 (73)
	NO	8 (7.5)	25 (23.4)	65 (60.7)	9 (8.4)	107 (27)
Making contact with Monkeys	YES	6 (12.5)	21 (43.8)	19 (39.6)	2 (4.2)	48 (12)

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		NO	75 (21.5)	101 (28.9)	154 (44.1)	19 (5.4)	349 (88)
If yes, Form of contact	**With wild or water Birds**	To catch as source of Protein	23 (31.1)	19 (25.7)	21 (28.4)	11 (14.9)	74 (27.3)
		Eats fruits that was eaten by Birds	39 (40.2)	27 (27.8)	29 (29.9)	2 (2.1)	97 (35.8)
		Eats corn that was eaten by Birds	43 (43.0)	27 (27.0)	23 (23.0)	7 (7.0)	100 (36.9)
	Contact with Bats	To kill the Bats	3 (21.4)	5 (35.7)	3 (21.4)	3 (21.4)	14 (4.9)
		Bats Droppings	83 (36.6)	61 (26.9)	47 (20.7)	36 (15.9)	227 (79.4)
		Eat fruits that was eaten by Bats	19 (42.2)	12 (26.7)	11 (24.4)	3 (6.7)	45 (15.7)
	Contact with Rodents	To catch as source of protein	39 (40.2)	25 (25.8)	22 (22.7)	11 (11.3)	97 (33.4)
		Benn bitten by a mouse	57 (47.5)	29 (24.2)	23 (19.2)	11 (9.2)	120 (41.4)
		Throwing away a dead mouse	23 (31.5)	24 (32.9)	19 (26.0)	7 (9.6)	73 (25.2)
	Contact with Monkeys	To catch and sell them	7 (14.6)	6 (12.5)	5 (10.4)	4 (8.3)	22 (45.8)
		To kill monkeys for spoiling of our crops	9 (18.8)	7 (14.6)	6 (12.5)	4 (8.3)	26 (54.2)

Hypothesis test on the relationship between educational status of the communities and the form of contact that exists between wild animals and the communities

Table 5, the hypothesis tested: the table shows that there is no significance association P<.05 between educational status of the communities and the contacts that exists between wild animals and the people of the communities, hence null hypotheses is accepted. However, there is significance association P>.05 between educational status of the communities and contact with monkeys and forms of contact with other types of wild animals.

Table 5: Hypothesis test on the relationship between educational status of the communities and the form of contact that exists between wild animals and the communities

Contact with Wild animals		**Responses**	Non-formal education	Primary School	Secondary School	Tertiary Institution	Chi square (x^2)	P-value
Making contact with Bats		YES	71 (24.)	99 (34.6)	103 (36.0)	13 (4.5)	29.32	<.0001
		NO	10 (9.0)	23 (20.7)	70 (63.1)	8 (7.2)		
Making contact with Wild/water Birds		YES	67 (24.7)	93 (34.3)	99 (36.5)	12 (4.4)	22.31	<.0001
		NO	14 (11.1)	29 (23.0)	74 (58.7)	9 (7.1)		
Making contact with Rodents		YES	73 (25.2)	97 (33.4)	108 (37.2)	12 (4.1)	27.19	<.0001
		NO	8 (7.5)	25 (23.4)	65 (60.7)	9 (8.4)		
Making contact with Monkeys		YES	6 (12.5)	21 (43.8)	19 (39.6)	2 (4.2)	5.01	.03
		NO	75 (21.5)	101 (28.9)	154 (44.1)	19 (5.4)		
If yes, Form of contact	**With wild or water Birds**	To catch as source of Protein	23 (31.1)	19 (25.7)	21 (28.4)	11 (14.9)	12.02	.0005
		Eats fruits that was eaten by Birds	39 (40.2)	27 (27.8)	29 (29.9)	2 (2.1)		

		Eats corn that was eaten by Birds	43 (43.0)	27 (27.0)	23 (23.0)	7 (7.0)		
	Contact with Bats	To kill the Bats	3 (21.4)	5 (35.7)	3 (21.4)	3 (21.4)	4.51	.03
		Bats Droppings	83 (36.6)	61 (26.9)	47 (20.7)	36 (15.9)		
		Eat fruits that was eaten by Bats	19 (42.2)	12 (26.7)	11 (24.4)	3 (6.7)		
	Contact with Rodents	To catch as source of protein	39 (40.2)	25 (25.8)	22 (22.7)	11 (11.3)	5.46	.02
		Benn bitten by a mouse	57 (47.5)	29 (24.2)	23 (19.2)	11 (9.2)		
		Throwing away a dead mouse	23 (31.5)	24 (32.9)	19 (26.0)	7 (9.6)		
	Contact with Monkeys	To catch and sell them	7 (14.6)	6 (12.5)	5 (10.4)	4 (8.3)	0.09	.76
		To kill monkeys for spoiling of our crops	9 (18.8)	7 (14.6)	6 (12.5)	4 (8.3)		

3.5. Attitude of the communities that favor the transmission of zoonotic viruses from wild animals to humans

Table 5, shows attitude of the communities that favor transmission of zoonotic viruses from wild animals to humans. Majority of the respondents (68.3%) said that there is no need to take any proper personal hygiene after making contact with wild animals, highest proportion 71.3% of the respondents preferred not report to health sector after unusual contact to wild animals, and also 63.7% of the respondents said that they would not report to health care even after unusual experience due to contact to different wild animals. Based on occupational status of the participants, farmers has the higher portion of the participants of which 181 (65.3%) preferred not to report to health care sector unusual experience that results after making contact with wild animals. These attitudes can pull the entire communities to brink of viral spillover to humans, for instance, farmers are the producers of foodstuff if they carry infectious diseases they would spread them to entire population.

Table 5: Attitude of the communities that favor the transmission of zoonotic viruses from wild animals to humans

		Occupation					
		Farmers	**Hunters**	**Fisherman**	**Driver**	**Student**	**Total**
Questions	**Responses**	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)	**(%)**
Taking proper personal hygiene after a contact with wildlife	YES	88 (31.8)	5 (20.8)	9 (32.1)	7 (30.4)	17 (37.8)	126 (31.7)
	NO	189 (68.2)	19 (79.2)	19 (67.9)	16 (69.6)	28 (62.2)	271 (68.3)
Reporting to health sector about a contact with wild animals	YES	85 (30.7)	4 (16.7)	6 (21.4)	6 (26.1)	13 (28.9)	114 (28.7)
	NO	192 (69.3)	20 (83.3)	22 (78.6)	17 (73.9)	32 (71.1)	283 (71.3)
Reporting to health care sector after unusual experience due to contact	YES	96 (34.7)	8 (33.3)	12 (42.9)	10 (43.5)	18 (40)	144 (36.3)
	NO	181 (65.3)	16 (66.7)	16 (57.1)	13 (56.5)	27 (60)	253 (63.7)

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The association between occupational status of the communities and their attitudes that may favor transmission of zoonotic viruses from wildlife to humans

Table 6: A chi square test shows that the relationship between occupational status of the communities and their attitudes that may favor transmission of zoonotic viruses were insignificant P>0.05.

		Occupation							
		Farmers	**Hunters**	**Fisherman**	**Driver**	**Student**	**Total**	**Chi Square (X2)**	**P-Value**
Questions	**Responses**	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)			
Taking proper personal hygiene after a contact with wildlife	YES	88 (31.8)	5 (20.8)	9 (32.1)	7 (30.4)	17 (37.8)	397	2.1	.13
	NO	189 (68.2)	19 (79.2)	19 (67.9)	16 (69.6)	28 (62.2)			
Reporting to health sector about a contact with wild animals	YES	85 (30.7)	4 (16.7)	6 (21.4)	6 (26.1)	13 (28.9)	397	2.94	.09
	NO	192 (69.3)	20 (83.3)	22 (78.6)	17 (73.9)	32 (71.1)			
Reporting to health care sector after unusual experience due to contact	YES	96 (34.7)	8 (33.3)	12 (42.9)	10 (43.5)	18 (40)	397	1.71	.19
	NO	181 (65.3)	16 (66.7)	16 (57.1)	13 (56.5)	27 (60)			

3.6. Relationship between attitudes of the communities towards emerging viral zoonoses and their educational status

The attitude of the participants towards emerging viral zoonotic diseases through different forms of contacts with wild animals with regard to their educational level was assessed and the study revealed that a statistically significant differences (P<0.05) were encountered. Of those who can have proper personal hygiene after making contacts with wild animals, about 15.2% of them have attended tertiary institutions while those with negative perception regarding personal hygiene after a contact were respondents with non-formal education that constituted about 26.4% of the participants. Those that have positive perception of health care intervention after making a contact with wild animals and also haven unusual experiences comprises about 14.0% of participants that goes through tertiary institutions, on the side of negative perception towards health intervention after unusual experience, about 27.6% of them were the ones with non-formal education. In addition, the study revealed that those with non-formal education had a greater propensity to be exposed to emerging viral zoonotics, with 42.2% of respondents having been exposed to emerging viral zoonotics through eating fruits that were previously consumed by bats, 43.0% having consumed corn that had been consumed by a green parrot, and 47.5% having been bitten by a mouse while sleeping. The likelihood of zoonotic viruses infecting human hosts was greater among those with less formal education (P0.05) compared to those who

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have attended tertiary institutions. However, there was no significant correlation (P>0.05) between the various forms of contact with wild animals that may result in the transmission of zoonotic viruses from wild animals to humans and the respondents' level of education. As shown in Table 7.

Table 7: Relationship between attitudes of the communities towards emerging viral zoonoses and their educational status

Variables		Responses	Non-formal education N (%)	Primary School N (%)	Secondary school N (%)	Tertiary institution N (%)	Chi square (X^2)	P-value
Proper Personal Hygiene after making contact with animals		YES	9 (7.2)	13 (10.4)	84 (67.2)	19 (15.2)	97.37	<.0001
		NO	72 (26.4)	109 (40.1)	89 (32.7)	2 (1.0)		
Report to health care sector after making contact with wild animals		YES	3 (2.6)	25 (21.9)	69 (60.5)	17 (14.9)	67.32	<.0001
		NO	78 (27.6)	97 (34.3)	104 (36.7)	4 (1.4)		
Report unusual experience to health care sector after making contact with wild animals		YES	11 (7.7)	25 (17.5)	87 (60.8)	20 (14.0)	77.7	<.0001
		NO	70 (27.6)	97 (38.2)	86 (33.9)	1 (0.4)		
Making contact with Bats		YES	71 (24.)	99 (34.6)	103 (36.0)	13 (4.5)	29.32	<.0001
		NO	10 (9.0)	23 (20.7)	70 (63.1)	8 (7.2)		
Making contact with Wild/water Birds		YES	67 (24.7)	93 (34.3)	99 (36.5)	12 (4.4)	22.31	<.0001
		NO	14 (11.1)	29 (23.0)	74 (58.7)	9 (7.1)		
Making contact with Rodents		YES	73 (25.2)	97 (33.4)	108 (37.2)	12 (4.1)	27.19	<.0001
		NO	8 (7.5)	25 (23.4)	65 (60.7)	9 (8.4)		
Making contact with Monkeys		YES	6 (12.5)	21 (43.8)	19 (39.6)	2 (4.2)	5.01	.03
		NO	75 (21.5)	101 (28.9)	154 (44.1)	19 (5.4)		
If yes, Form of contact	**With wild or water Birds**	To catch as source of Protein	23 (31.1)	19 (25.7)	21 (28.4)	11 (14.9)	12.02	.0005
		Eats fruits that was eaten by Birds	39 (40.2)	27 (27.8)	29 (29.9)	2 (2.1)		
		Eats corn that was eaten by Birds	43 (43.0)	27 (27.0)	23 (23.0)	7 (7.0)		
	Contact with Bats	To kill the Bats	3 (21.4)	5 (35.7)	3 (21.4)	3 (21.4)	4.51	.03
		Bats Droppings	83 (36.6)	61 (26.9)	47 (20.7)	36 (15.9)		
		Eat fruits that was eaten by Bats	19 (42.2)	12 (26.7)	11 (24.4)	3 (6.7)		
	Contact with Rodents	To catch as source of protein	39 (40.2)	25 (25.8)	22 (22.7)	11 (11.3)	5.46	.02

		Benn bitten by a mouse	57 (47.5)	29 (24.2)	23 (19.2)	11 (9.2)		
		Throwing away a dead mouse	23 (31.5)	24 (32.9)	19 (26.0)	7 (9.6)		
	Contact with Monkeys	To catch and sell them	7 (14.6)	6 (12.5)	5 (10.4)	4 (8.3)	0.09	.76
		To kill monkeys for spoiling of our crops	9 (18.8)	7 (14.6)	6 (12.5)	4 (8.3)		

4. DISCUSSION

Findings of this cross-sectional study indicated that emerging viral zoonotic diseases are important public health problem in Sabon-Birni and its sub-communities because awareness, knowledge and perception of emerging viral zoonotic diseases are low among the respondents. This report is similar to finding of Usuwa et al, 2020 where they reported low level of knowledge in there study titled "Knowledge and risk perception towards Lassa fever infection among residents of affected communities in Ebonyi State, Nigeria: implications for risk communication"; but, this study contradicted the work of Tenzin (Tenzin *et al.*, 2012 in Teleghu, Bhutan); where they reported higher knowledge, attitude and perception of the community towards Rabies, in their work. However, the current study also identified some knowledge gaps regarding some selected emerging viral zoonotic diseases, many of the respondents had not heard of Monkeypox, Avian influenza, Yellow fever and Lassa hemorrhagic fever and their modes of transmission, indicating that the awareness on emerging viral Zoonoses and Education is necessary in Sabon-Birni and its sub-communities.

It is good for the communities to understand their attitudes that may favor a rapid viral zoonotic diseases transmission and how to minimize the attitudes through prevention-seeking behaviors of which is important for viral zoonotic diseases prevention in humans (Tenzin *et al.*, 2012). This study identified low prevention-seeking behaviours in the communities, because majority of the respondents would not report to health care sector due to unusual experience after making contacts with wild animals.

However, the reporting of unusual experience due to contacts were higher among Farmers and Students, and also among the age group of 20-29. These findings are comparable with previous studies, reporting that larger number of participants have higher positive attitudes towards transmission of emerging viral zoonoses, making contacts with wild animals such as Bats, Birds and Rodents without taking proper care of oneself.

Many of the participants have stated that they have interacted with Rodents that resulted to the rodents bite injuries and did not reported to health care sectors for intervention owing to lack of awareness regarding emerging viral zoonotic diseases.

5. CONCLUSION AND RECOMMENDATION

This cross-sectional study has determined the knowledge, attitude, and perceptions of residents of Sabon-Birni and its sub-communities towards emerging viral zoonotic diseases and the role of education, age group and occupation towards their attitude that that could drive them to the brink of transmission of emerging viral zoonotic diseases. The study revealed that age, religion, education, occupation and marital status of the respondents were significantly associated with their knowledge on the emerging viral zoonotic diseases in which respondents with the age group 20-29 years, Muslims all, farmers, and married have lower knowledge of the modes of transmission of emerging viral zoonoses.

The role of education of the respondents on their attitude towards emerging viral zoonotic diseases transmission prevention, was found to be statistically insignificant.

With the way they interact differently with wild animals, participants with non-formal education had higher contacts with wildlife, non-reporting to health care sector for unusual contact and unusual experience after making contacts with wild animals.

Based on the findings of this cross-sectional study, there is need to enhance awareness creation and training programs against emerging viral zoonotic disease transmission and also on prevention and control in these communities; this should be best if those with non-formal education, hunters, fishermen and farmers are to be targeted. This should help communities with lower educational status to be able to understand more about emerging viral zoonoses. Besides, the

establishment of inter-sectoral engagement to control and prevention strategies for common zoonotic diseases should be enhanced.

REFERENCES

Allen T., Murray A.K., Carlos Z.T., Morse S.S., Rondinini C., Marco M.D., Breit N., Kevin J. Daszak P & Oival. (2017). Global hotspots and correlates of emerging zoonotic diseases. *Nature Communications*. DOI: 10.1038/s41467-017-00923-8

Archie C.A. Clements, Dirk U.P. (2009). Emerging viral zoonoses: Frameworks for Spatial and Spatiotemporal Risk Assessment and Resource Planning. *The Veterinary Journal* 182, 21–30. https://www.sciencedirect.com/science/article/pii/S1090023308001718

Birgitta A., Hilde K. (2007). Zoonoses in the Emergence of Human Viral Diseases. *Emerging Viruses in Human Populations.* https://doi.org/10.1016/S0168-7069(06)16003-6

Brian Hjelle and Fernando Torres-Perez. (2009). Rodent-Borne Viruses. https://www.academia.edu/1943776/Rodent_Borne_Viruse

Brown C. (2004). Emerging zoonoses and pathogens of public health significance – an overview. *Rev. sci. tech. Off. int. Epiz.* 23 (2), 435-44. http://boutique.oie.int/extrait/435442brown.pdf

Bowen S.G., Tomori., Herta W., Casals., Noonan A, & Downs W.G. (1975). Lassa fever in Onitsha, East Central State, Nigeria, in 1974. *Bull World Health Organization.* 52(4-6): 599–604. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2366632/pdf/bullwho00466-0205.pdf

Chomel B.B. (2009). Zoonoses. Academic Press. https://doi.org/10.1016/B978-012373944-5.00213-3

Crameri G., & Wang L.F. (2014). Emerging zoonotic viral diseases. Rev. sci. tech. Off. int. Epiz., 33 (2), 569-581. http://dx.doi.org/10.20506/rst.33.2.2311

Dawit T., Daryos F., Worku T., Alemayahu R, & Amene F. (2013). Perception of the public on the common zoonotic diseases in Jimma, Southwestern Ethiopia. International Journal of Medicine and Medical Sciences, 5(6), pp. 279-285. https://doi.org/10.5897/IJMMS2013.0931

Dhanasekaran V., Reshmi M., Gavin J. D., Smith. (2015). RNA Viruses Reassortment: An Evolutionary Mechanism for Host Jumps and Immune Evasion. *PLoS Pathog* 11(7): e1004902. doi: 10.1371/journal.ppat.1004902. https://journals.plos.org/plospathogens/article?id=10.1371/journal.ppat.1004902

Fesseha H, Abebe F. (2020). Assessment of community knowledge, attitude and practice on common zoonotic diseases in Jinka town, Southern Ethiopia. *G Med Sci*. 2020; 1(3): 018-029. https://www.doi.org/10.46766/thegms.virology.20072206

Fitsum D, & Mahendra P, (2017). Emerging Viral Zoonoses and Their Implications on Public Health. *World Applied Sciences Journal*, 35 (2): 188-198. DOI:10.5829/idosi.wasj.2017.188.198

Heeney J.L. (2006). Zoonotic Viral Diseases and the Frontier of Early Diagnosis, Control and Prevention. *Journal of Internal Medicine* v260, 5 p.399-408. https://doi.org/10.1111/j.1365-2796.2006.01711.x

Hiko A., Yikale B, & Serda B. (2018). Community Knowledge towards Zoonotic Diseases and Attitude to One Health Approach in selected City of Ethiopia. *Journal of Health Education Research & Development*, 6:4. https://doi.org/10.4172/2380-5439.1000276

Ibrahim T.D., Andrew M., Sonja J.O., Inzune H., Aisha B.G., Ekanem E.E., E.B.A. Coker, Henry A., & Adebayo A.A. (2012). Influenza Viruses in Nigeria, 2009–2010: Results from the First 17 Months of a National Influenza Sentinel Surveillance System. *The Journal of Infectious Diseases* 206(S1):S121–8. DOI: 10.1093/infdis/jis584

James L. N., Wood., Melissa L., Linda W., Hayley M. Anthony R., Fooks., Kate E., Jones., Olivier R., Dina D., David T. S., Hayman., Kate S., Baker, Alison J., Peel, Alexandra O., Kamins., Jakob F., Yaa N., Richard S., Robert F., Breiman, Jonathan H., Epstein, Hume E., Field, Andrew A., Cunningham. (2012). A Framework for the study of zoonotic disease emergence and its drivers: spillover of bat pathogens as a case study. National library of medicine. v.367 (1604). https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3427567/

Jennifer Peat. (2001). Health science research: a handbook of quantitative methods. *Allen & Unwin.* http:s//www.allenandunwin.com

Japhet Killewo. (2010). Epidemiology and demography in Public Health. *Academic Press.* https://www.elsevier.com/books/epidemiology-and-demography-in-public health/killewo/978-0-12-382200-0

Jie C., Fang L., Zheng-L.S. (2019). Origin and evolution of pathogenic coronaviruses. *Nature*

Reviews Microbiology.2019 Mar; 17(3):181-192. doi: 10.1038/s41579-018-0118-9.

Kriegel E.R., Cherney D.J.R., Kiffner C, (2021). Conventional knowledge, general attitudes and risk perceptions towards zoonotic diseases among Maasai in Northern Tanzania. https://doi.org/10.1016/j.heliyon.2021.e07041

Malik S. Y., Singh K. R., Dhama K. (2020). Animal-Origin Viral Zoonoses. *Springer nature Singapore*. https://doi.org/10.1007/978-981-15-2651-0

Murphy, Fredrick A. (2008). Emerging zoonoses: The challenge for Public Health and biodefense. *Preventive veterinary medicine* 86, 216-223. doi: 10.1016/j.prevetmed.2008.02.009

Mbazulu M. K., Mboera E.G., Leonard., Wumba R., Zanga K. J., Luzozlo K.J., Misinzo G., Kimera I.S, (2019). Community knowledge, attitude and practices on mosquitoes and mosquito borne viral diseases in Kinshasa, Democratic Republic of the Congo. *Research Square.* https://doi.org/10.21203/rs.2.14941/v1

Meslin F.X., Stöhr K., & Heymann D. (2000). Public health implications of emerging zoonoses. Rev. sci. tech. Off. int. Epiz., 2000,19 (1), 310-317. https://doc.woah.org/dyn/portal/index.xhtml?page=alo&aloId=29623

Nigeria Centre for Disease Control. (2021). Weekly Epidemiological Report. v12, 19. https://reliefweb.int/report/nigeria/ncdc-weekly-epidemiological-report-issue-volume-12-no19-1st-june-2021

Oscar V., Eric G, & Emmanuel Y., Sarfo-T. (2021). Assessment of Knowledge, Attitude, Perception and Practices on Rabies Disease in the GA East Municipality, Ghana. *Asian Journal of Research in Infectious Diseases.* 6(2): 26-36. https://journalajrid.com/index.php/AJRID/article/view/30192

Peterson E., Kantele A., Koopmans M., Asogun D., Yinka-Ogunleye A., Ihekweazu C., Zumla A. (2019). Human Monkeypox epidemiologic and clinical characteristics, diagnosis, and prevention. *Infect Dis Clin N Am* 33:1027. https://doi.org/10.1016/j.idc.2019.03.001

Richard D.S., Evangeline O., Kofi B.J.H., Samuel O.B., William A., Terra R. K. (2021). Viral Zoonoses of National Importance in Ghana: Advancements and Opportunities for Enhancing Capacities for Early Detection and Response. DOI: 10.1155/2021/8938530

Rolf B., Alexander & Graevenitz., Peter K., Hans G. S., Tino S., Werner S., Horst Z. (2016). Zoonoses: Infectious Diseases Transmissible Between Animals and Humans (Fourth Edition). doi:10.1128/9781555819262, https://estore.asm.org

Satesh B., Cheryl C.M., Calum N.L. Macpherson, (2013). Human Behavior and The Epidemiology of Viral Zoonoses. *Wiley Online Library*. https://doi.org/10.1002/9781118297469.ch6

Singh B.B., Gajadhar A.A. (2014). Role of India's wildlife in the emergence and re-emergence of zoonotic pathogens, risk factors and public health implications. Acta Trop. 138: 67–77, DOI: 10.1016/j.actatropica.2014.06.009

Swai S. E., Schoonman L, & Daborn J. C. (2010). Knowledge and Attitude towards Zoonoses among Animal Health Workers and Livestock Keepers in Arusha and Tanga, Tanzania. *Tanzania journal of health research* 12:4. https://www.ajol.info/index.php/thrb/article/view/54709

Tenzin, Navneet K., Dhand, Bir Doj Rai, Changlo, Sangay T., Karma T., Pema U., Karma S., Michael P., Ward. (2012). Community-based study on knowledge, attitudes and perception of rabies in Gelephu, south-central Bhutan. *International health* 4, 210-219. http://dx.doi.org/10.1016/j.inhe.2012.03.005

Usuwa, S. I., Akpa O. C., Umeokonkwo D. C., Umoke J. M., Oguanuo S. C., Olorukooba A. A., Bamgboye E, & Bakogun S., M. (2020). Knowledge and risk perception towards Lassa fever infection among residents of affected communities in Ebonyi State, Nigeria: implications for risk communication. BioMed Central, 20:217. https://doi.org/10.1186/s12889-020-8299-3

Venkatesan G., Balamurugan V., Gandhale P.N., Singh R.K, & Bhanuprakash V. (2010). Viral Zoonosis: A Comprehensive Review. *Asian Journal of Animal and Veterinary Advances.* Vol. 5(2) 77-92. DOI: 10.3923/ajava.2010.77.92

Walker J.W., Han B.A., Ott I.M., Drake J.M. (2018). Transmissibility of emerging viral zoonoses. PLoS ONE 13(11): e0206926. https://doi.org/10.1371/journal.pone.0206926

Williams E.S., Yuill T., Artois M., Fischer J., & Haigh S.A. (2002). Emerging Infectious Diseases in Wildlife. http://dx.doi.org/10.20506/rst.21.1.1327

World Health Organization. (2021). Health Topics: Yellow Fever. https://www.who.int/health-topics/yellow-fevertabtab_1

Wohl S, & Wu K. (2016). Growing together: How viruses Have Shaped Human Evolution. Science In The News (SITN). https://www.youtube.com/user/SITNBoston