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Research Article

Knowledge, Attitudes, and Practice about Crimean Congo Hemorrhagic Fever among Veterinarians in Pakistan

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ABSTRACT Crimean Congo Hemorrhagic Fever (CCHF) is a neglected viral zoonotic tick-borne disease and occupational hazard with apparent prevalence in Middle East, Asia, Africa and Eastern Europe countries including Pakistan. This disease poses a significant public health threat due to its high case fatality rate (ranging from 5% to 50%) and strong nosocomial transmission potential. General Pakistani population becomes susceptible due to the increased exposure with sacrificial animal on religious events. To assess the Knowledge, Attitude, and Practices (KAP) associated with CCHF transmission and control, a questionnaire based cross-sectional survey was conducted regarding Knowledge, Attitude and Practices associated with CCHF transmission and control. Total sample number is 200 out of which 199 respondents completed the questionnaire and 1 form was rejected due to incomplete response. The study findings revealed a varying level of knowledge among veterinarians regarding CCHF transmission, vector species, and risk factors. Knowledge and practices of veterinarians with work experience (more than 10 years) were found significant, whereas the attitude of veterinarians in the age group 31-35 years was significantly associated with positive perceptions about CCHF. The study concludes that these findings will contribute to effective policymaking and strategy development aimed at raising awareness among veterinarians, thereby aiding in the prevention and control of future hazards and outbreaks of Crimean-Congo Hemorrhagic Fever.

KEYWORDS Crimean-Congo Hemorrhagic Fever (CCHF), Zoonotic Disease, Veterinarians, Knowledge, Attitude, Practices (KAP), Pakistan

Introduction

Crimean Congo Hemorrhagic Fever (CCHF) is a deadly viral vector-borne disease of zoonotic concern (Nejati *et al*, 2024). This viral disease remains subclinical in infected animals but causes a serious threat to human health. Infected human shows non-specific symptoms like fever, myalgia, abdominal pain, muscle fatigue, headache, and pinpoint or small hemorrhages (Mehmood *et al*, 2022). In every 6 cases, only 1 patient shows clinical signs and more than 80% of cases do not show any signs (Bodur *et al*, 2012).having case fatality rate between 5% to 50% (Gevorgyan *et al*, 2019). CCHF is prevalent in many regions like Middle East, Asia, Africa and Eastern Europe (Al-Abri *et al*, 2017).The treatment is supportive, although anti-viral drug therapy i.e., Ribavirin is effective in only some cases. According to previous studies, (Dowall *et al*, 2017) **,** currently no licensed vaccine or treatment is available for CCHF. CCHF is caused by CCHF virus, a negative-stranded RNA virus, belongs to the genus *Orthonairovirus* of family Bunyaviridae (Rahden *et al*, 2019)**.** Wild animals like sheep, goats, cattle, and hares act as the main reservoir host of CCHF Virus (Shayan *et al*, 2015). CCHF virus transmits via both direct and indirect modes. In direct mode of transmission, it is transmitted to humans via direct contact with infected animal body fluids and secretions, especially during physical examination and drug administration, or mainly due to tick bite (Ahmed *et al*, 2018). Indirect mode is the less important mode of transmission such as the ingestion of undercooked or raw meat or unpasteurized milk of infected domestic and wild animals (Fazlalipour *et al*, 2016). It is mainly transmitted by ticks of Family Ixodidae including *Rhiphicephalus, Boophilus, Dermacentor, Hyalomma* (mainly *hyalomma*

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marginatum) (Ahmed *et al*, 2018). CCHF also has strong nosocomial potential.

CCHF is a neglected tropical disease, (Ahmed *et al*, 2021) and most cases are reported near the Holy festival Eid-ul-Adha in Muslim countries. In Pakistan, 365 cases of CCHF were confirmed by National Institute of Health (NIH) between 2014 and 2020 with a 25% case fatality rate (Jamil *et al*, 2022)**.** Baluchistan has the highest prevalence of CCHF followed by KPK and Punjab, From the Last 5 years, Baluchistan has had 47% Prevalence followed by 17% in Punjab, 15% in KPK, 14% in Sindh, 4% in Islamabad, 2% in former Federally Administered Tribal Areas (FATA) and 1% cases from Azad Jammu Kashmir (AJK) (Ahmed *et al*, 2021).

CCHF is difficult to control in Pakistan due to lack of awareness among public and veterinarians. The most realistic approach, to control or prevent the widespread movement of vectors, is the use of Acaricides (drugs intend to use for ticks' control), maintaining hygiene measure (World Health Organization, 2022) raising awareness regarding CCHF at government level. The main focus of this cross-sectional study is to assess the knowledge, attitudes, and practices of CCHF among veterinarians in Punjab, Pakistan. The findings of this study will help in policy-making, developing strategies and interventions to raise awareness among veterinarians to prevent or control the future hazards and outbreaks of CCHF.

Materials and Methods

Ethics statement

Any name and email of the respondent was not mentioned in this study, and privacy of the respondent would be ensured, so that no person could be tracked. Before submission, respondent could retain the completed form at any time. After being informed about the aims and objective of the study, a written consent form was collected from the participants at the beginning of online survey.

Study design and Study population

A cross-sectional study was conducted to assess the KAP on CCHF of veterinary practitioners working in public veterinary hospitals in Punjab. After considering the population size, the convenient sample size (n=200) was determined from almost all the districts of Punjab province. The study population is veterinary practitioners working in Punjab province, Pakistan. According to Pakistan Bureau of statistics data, 17,257 registered veterinary medical practitioners (RVMP) are working in Pakistan (Pakistan Bureau of Statistics, 2021). They are qualified professionals and registered with Pakistan Veterinary Medical Council (PVMC) after completing the degree of Doctor of Medicine (DVM). There are 1,020 public sector Veterinary hospitals in Pakistan in which PVMC registered Veterinary Officers are working. The target population is PVMC registered Veterinary Officers working in Punjab's Government Veterinary Hospitals.

Questionnaire development

Data were collected using a structured questionnaire specifically designed for this study. An online questionnaire was created using Google form platforms. The questionnaire was created by reviewing different related published articles and in guidance of relevant experts. The survey divided into 4 sections: 1) Demographic information of person, 2) Assessment of knowledge regarding etiology, vector involved and transmission of CCHF, 3) Attitude towards diagnosis and treatment of CCHF, 4) Assessment of practices regarding prevention and control of CCHF. There were 23 questions in survey including 21 close-ended end questions and 02 open-ended questions only.

The relevant practices explored in this study included: (i) taking standard precautions during animal handling, (ii) implementing protective measures to protect themselves, (iii) having valuable sources of information regarding CCHF, (iv) guiding butchers or meat handlers about the potential risk of CCHF, and (v) following standard procedures to minimize the risk of transmission of CCHF.

To explore the association of demographic variables with each identified practice, five separate multivariable logistic regression models were built. The following practices were recategorized as dichotomous variables before inclusion in the univariable analysis: Taking Standard Precautions (alternatives "Always" and "Frequently" were categorized as "Yes", while alternatives "Rarely" and "Never" were categorized as "No"), Implement Protective Measures (alternatives "Always" and "Frequently" were categorized as "Yes", while alternatives "Rarely" and "Never" were categorized as "No"), and having a Valuable Source of Information (alternatives "Always" and "Frequently" were categorized as "Yes", while alternatives "Rarely" and "Never" were categorized as "No"). Follow Standard Procedures (alternatives "Always" and "Frequently" were categorized as "Yes", while alternatives "Rarely" and "Never" were categorized as "No"). Hence, the dependent variables in each model included the practice as an outcome as a dichotomous variable, such as Standard Precautions (Yes/No), Protective Measures (Yes/No), Having a Valuable Information Source (Yes/No), Guiding Butchers and Meat Handlers (Yes/No), and Following Standard Procedures to Minimize Transmission (Yes/No). The independent variables encompass demographic factors such as gender, type of practitioner, experience, and qualification.

Data collection

Data were collected by the target population disseminated via WhatsApp, LinkedIn, and by personal contacts through email or phone. Prior to data collection, a pilot survey with 10 veterinarians was conducted and revised according to feedback. Participants were fully aware and voluntarily participating in the study. No personal information in term of name, email or area specification is mentioned in the study and arbitrary serial numbers was given. A consent was filled by the respondent and they could opt-out of the survey at any time. To get maximum responses, several reminders should be done via emails or phone.

Data Analysis

Data were compiled using Microsoft Excel (Microsoft Corporation, USA). Descriptive statistics, including percentages, were calculated for each variable of interest. A scoring system for questions was employed to assess the knowledge, attitude, and practices of veterinarians, where a correct response contains 1 point, and an incorrect response

was given 0 point. The mean scores for each section were calculated and respondents were categorized as per their score levels. For knowledge section, questions were also scored as corrected or not-corrected for initial analysis. Demographic variables such as gender, qualifications, years of experience, and type of veterinary practitioner were used for independent variable for statistical analysis. The assumptions for parametric statistical analysis were checked using the Shapiro-Wilk test. Use of parametric and non-parameteric tests was decided on the basis of normality assumptions. Pearson's correlation test was conducted to determine the correlation between mean knowledge and practice scores. Chi square test was used to determine the association between level of KAP scores and independent variables. All statistical analyses were conducted using R for Windows software (version 3.2.1., http://www.r-project.org/) and RStudio as an interface (version 0.99.447, Inc., Boston, MA, USA, https://www.rstudio.com/).

Results

A total of 200 field veterinarians were participated in this study from all over the Punjab. Only one questionnaire had to be rejected due to incomplete responses. All of them are Government veterinary practitioners (n=199), out of which majority 81% (n=162) are males and 19% (n=37) are females. Among all the respondents, 48% (n=96) had Doctor of Veterinary Medicine (DVM) as their highest degree, 46% (n=92) had M-Phil in various veterinary fields and 5.5% (n=11) was Ph.D. scholars. As the working experience is related, 46% (n=91) had more than 10-year field experience, 32% (n=63) had experience of 7-9 years and others had less than 7 years of experience.

Knowledge section

A varying level of knowledge regarding CCHF was determined (Fig. 1). Majority of participants (>84%) could not identify all the species responsible for CCHF transmission to humans. Majority of participants knew the suitable season of spread, zoonotic nature, CCHF transmission to humans, and heard about CCHF before. When correctness level of individual questions was associated with independent variables, it was revealed that veterinarians with more years of experience correctly answered the CCHF spread to humans ($p < 0.017$) and clinical signs in humans ($p < 0.07$). Veterinarians working in the rural settings (22.41%) experienced significantly ($p < 0.042$) more tick bite as compared to veterinarians in urban settings (10.14%) while males (16.67%) have experienced significantly more tick bites ($p < 0.033$) as compared to female veterinarians (2.7%).

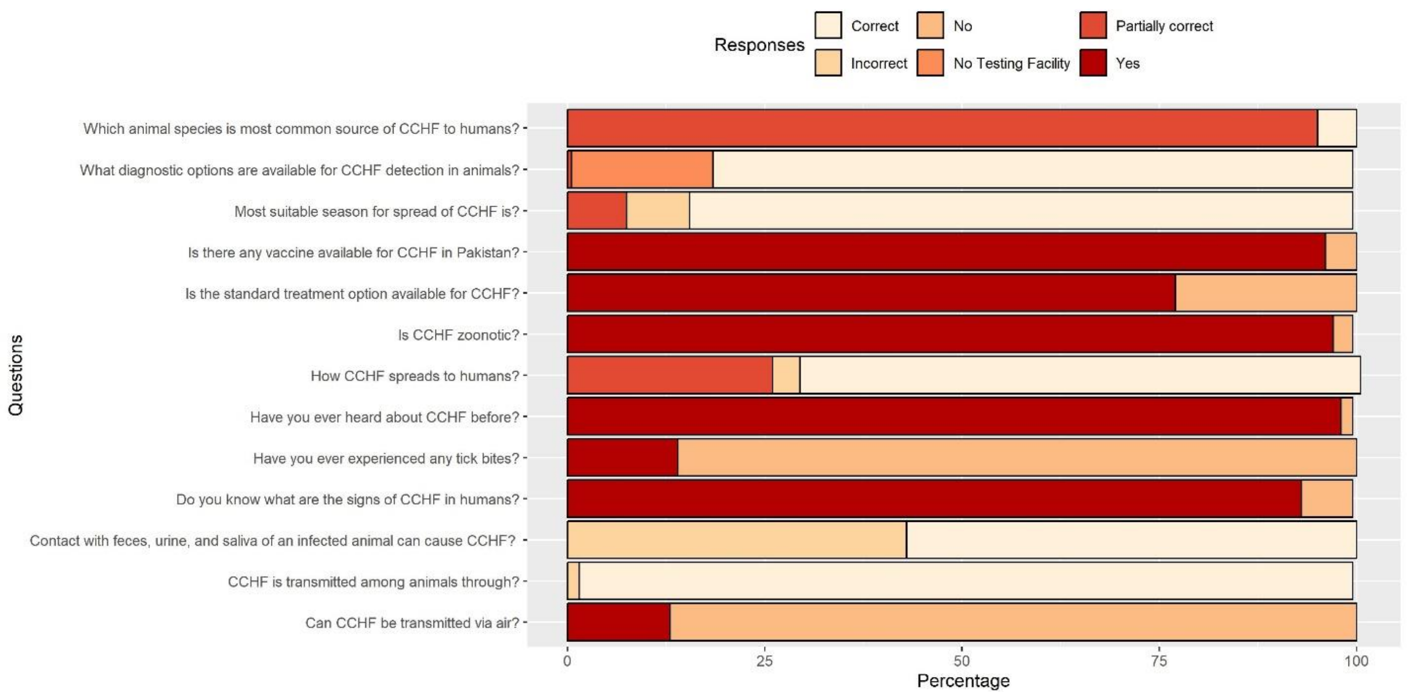

Fig. 1: Summary of the responses related to knowledge section. There were 13 questions included in this section.

The mean knowledge score of males was higher (37%) as compared to female respondents (12%) but statistically no difference was found (p=0.6). (Table 1). The mean knowledge score of respondents with PhD and MPhil were higher (27% and 15%, respectively) than that of respondent's with DVM (9%) and there was little statistical difference was found (p=0.059). The respondents having experience more that 10years had higher level of knowledge (54%) and those having experience of 4-6years had lower mean knowledge (11%) but statistically no difference was found ($p > 0.9$).

Table 1: Comparison of Knowledge levels among demographic characteristics of the respondents. Knowledge level was divided into three levels to classify the respondents.

Characteristic	Levels	Knowledge Level			p-value
		50-75% N = 155	>75% N = 26	<50% N = 18	
Gender	Female	31 (20%)	3 (12%)	3 (17%)	0.7
	Male	124 (80%)	23 (88%)	15 (83%)	
Age	<30Y	31 (20%)	3 (12%)	2 (11%)	0.6
	31-35Y	59 (38%)	10 (38%)	11 (61%)	
	36-40Y	34 (22%)	9 (35%)	3 (17%)	
	40-45Y	19 (12%)	3 (12%)	1 (5.6%)	
	46-50Y	8 (5.2%)	0 (0%)	0 (0%)	
	51 Y+	4 (2.6%)	1 (3.8%)	1 (5.6%)	
Residency	Rural	46 (30%)	8 (31%)	4 (22%)	0.9
	Urban	109 (70%)	18 (69%)	14 (78%)	
Education	DVM	74 (48%)	9 (35%)	13 (72%)	0.059
	MPhil	74 (48%)	14 (54%)	4 (22%)	
	Ph. D	7 (4.5%)	3 (12%)	1 (5.6%)	
Working Experience (Years)	0-3Y	21 (14%)	3 (12%)	2 (11%)	>0.9
	10Y and above	69 (45%)	14 (54%)	8 (44%)	
	4-6Y	16 (10%)	1 (3.8%)	2 (11%)	
	7-9Y	49 (32%)	8 (31%)	6 (33%)	

Attitude Section

More than 50% of the respondent believe that CCHF is a dangerous disease and about 75% strongly agreed that veterinarians and animal handlers are at risk of getting the disease. More than 30% strongly agreed that tick (vector for CCHF) bites can be reduced by using gloves and long shoes. 25% of the respondent think that Veterinary hospitals in their areas are not provided any sufficient facilities to diagnose and treat CCHF. Majority of the veterinarians (About 50%) was strongly agreed that there is need of more awareness among general public about CCHF. (Fig.2)

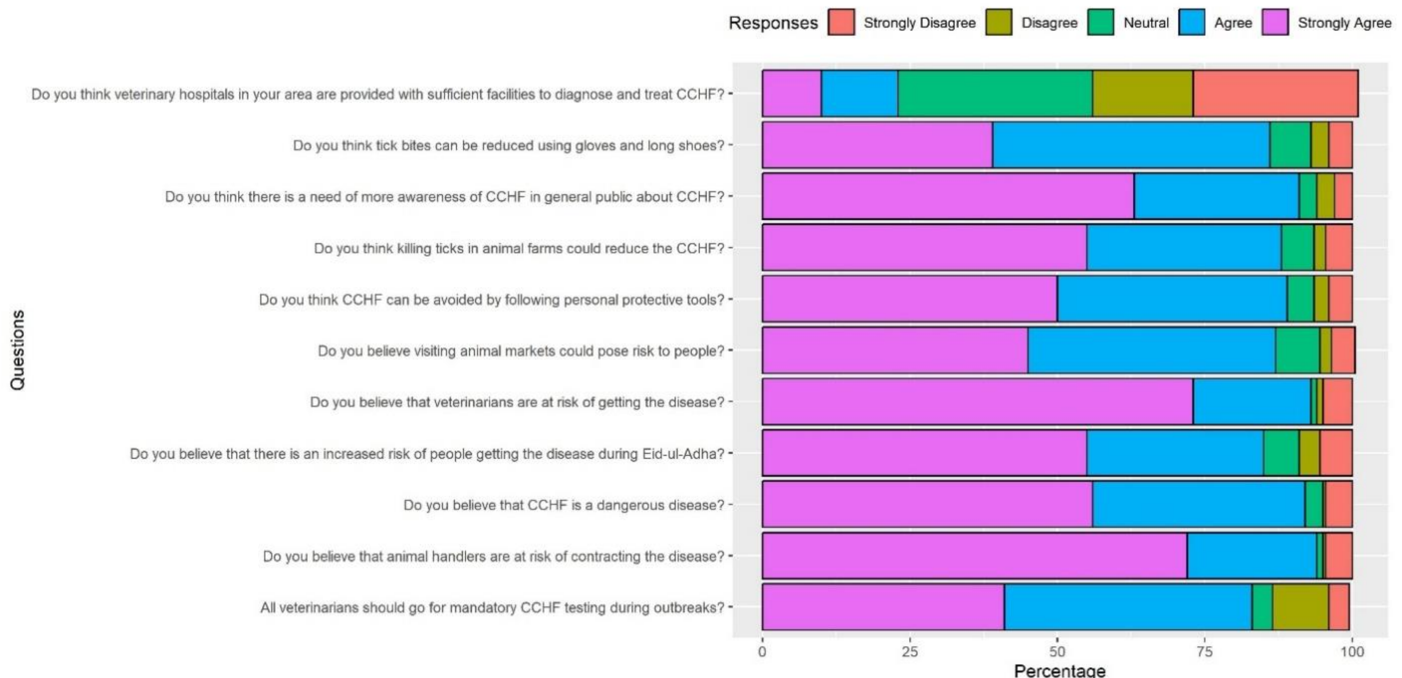

Fig. 2: Summary of the responses related to attitude section. There were 11 questions related to attitude. The responses to these questions were recorded using ordinal scale.

Demographic variables such as Age and work experience were found significantly associated with attitude level (Table 2). Respondents under 30 years old demonstrate a notably higher attitude score (34%, p <0.032). Furthermore, respondents aged 36-40 years and 31-35 years display moderate levels of good attitudes, with 27% (n=11) and 24% (n=10) respectively. On the other hand, Respondents with 10 or more years of experience show the highest proportion of both high and low attitudes, with 46% in each category (p < 0.004) while, respondents with 7-9 years of experience have a significant share of low attitudes at 35%, despite having a moderate 17% reporting high attitudes.

Table 2: Association of attitude level with demographic factors of respondents. Attitude level was divided into two levels to classify the respondents.

Characteristic	Levels	Attitude		p-value
		Positive (>75%) N = 41[1]	**Negative (<75%)** N = 158[1]	
Gender	Female	7 (17%)	30 (19%)	0.8
	Male	34 (83%)	128 (81%)	
Age	<30Y	14 (34%)	22 (14%)	0.032
	31-35Y	10 (24%)	70 (44%)	
	36-40Y	11 (27%)	35 (22%)	
	40-45Y	5 (12%)	18 (11%)	
	46-50Y	1 (2.4%)	7 (4.4%)	
	51Y+	0 (0%)	6 (3.8%)	
Residency	Rural	14 (34%)	44 (28%)	0.4
	Urban	27 (66%)	114 (72%)	
Education	DVM	21 (51%)	75 (47%)	>0.9
	MPhil	18 (44%)	74 (47%)	
	Ph.D	2 (4.9%)	9 (5.7%)	
Working Experience (Years)	0-3Y	12 (29%)	14 (8.9%)	0.004
	10Y and above	19 (46%)	72 (46%)	
	4-6Y	3 (7.3%)	16 (10%)	
	7-9Y	7 (17%)	56 (35%)	

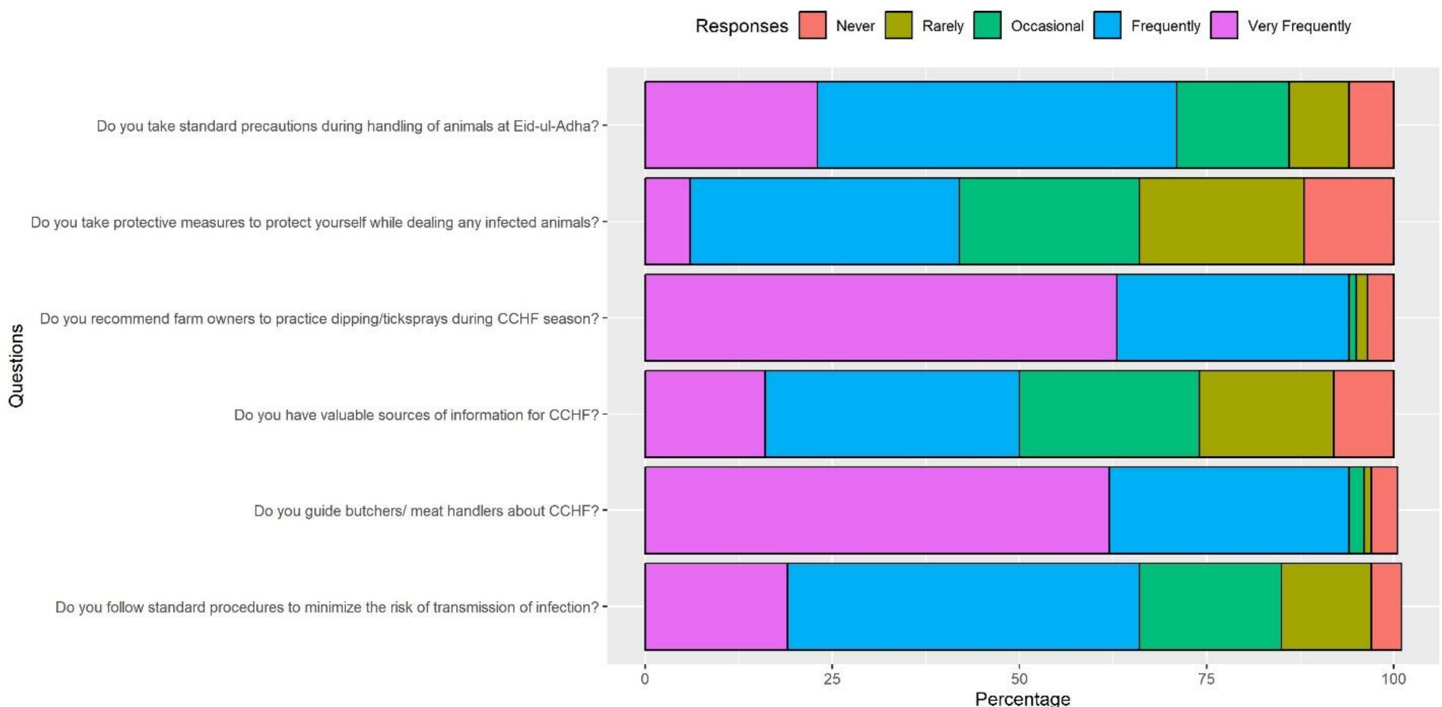

Fig. 3: Summary of the responses related to Practices against CCHF. There were 6 major practices addressed in this questionnaire. Few practices were followed by majority of respondents while most of the practices showed varying levels.

Practices section

While handling of animals at Eid-ul-Adha majority of the veterinarians (about 50%) frequently take standard precautions (Fig. 3). More than 20% of respondent rarely take protective measures to protect themselves while dealing with any infected animals. Majority of the field veterinarians (more than 50%) recommend farm owners to practice dipping/tick spray during CCHF season and also guide butchers or meat handlers about potential risk of CCHF. About 45% follow the standard procedures to minimize the risk of transmission of CCHF infection.

Veterinarians having working experience more than 10 years had highest practices (47%) n=91 to take precautionary and protective measures against CCHF to protect themselves (Table 3). 15% of veterinarians with experience 4-6yr (n=67) had bad practices while 20% of

respondent having 3-year experience have good practices to protect themselves and aware the animal or meat handler about the risk of CCHF.

Table 3: Association of demographic variables with Practices score levels.

Characteristic	Levels	Practices			p-value
		Moderate 50-75% N = 62[1]	**Good >50%** N = 55[1]	**Bad <50%** N = 82[1]	
Gender	Female	12 (19%)	9 (16%)	16 (20%)	>0.9
	Male	50 (81%)	46 (84%)	66 (80%)	
Age	<30Y	14 (23%)	10 (18%)	12 (15%)	0.2
	31-35Y	22 (35%)	23 (42%)	35 (43%)	
	36-40Y	12 (19%)	14 (25%)	20 (24%)	
	40-45Y	10 (16%)	7 (13%)	6 (7.3%)	
	46-50Y	4 (6.5%)	0 (0%)	4 (4.9%)	
	51Y+	0 (0%)	1 (1.8%)	5 (6.1%)	
Residency	Rural	17 (27%)	17 (31%)	24 (29%)	0.9
	Urban	45 (73%)	38 (69%)	58 (71%)	
Education	DVM	26 (42%)	28 (51%)	42 (51%)	0.8
	MPhil	31 (50%)	25 (45%)	36 (44%)	
	Ph.D	5 (8.1%)	2 (3.6%)	4 (4.9%)	
Working Experience (Years)	0-3Y	12 (19%)	9 (16%)	5 (6.1%)	0.05
	10Y and above	29 (47%)	25 (45%)	37 (45%)	
	4-6Y	2 (3.2%)	4 (7.3%)	13 (16%)	
	7-9Y	19 (31%)	17 (31%)	27 (33%)	

Comparison of KAP sections:

The comparison of knowledge, attitude, and practices revealed distinct patterns (Fig. 4). Pearson's correlation among KAP scores revealed relationship of these sections. Attitude was found having significant and moderate correlation with Practices ($p < 0.001$). While knowledge and Attitude sections were also found having mild or low correlation ($p > 0.10$).

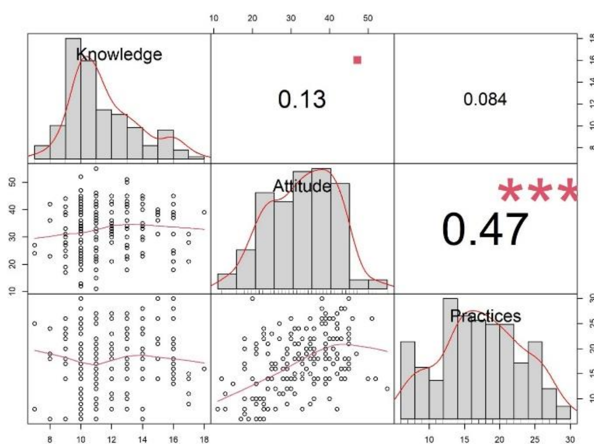

Fig. 4: Comparison of scores obtained by respondents across KAP sections. A significant positive correlation was observed between knowledge and attitude. Veterinarians had significantly higher knowledge scores compared to animal owners. Most respondents demonstrated low knowledge with poor attitude and bad practices.

Discussion

As per authors' knowledge, it is the first KAP study focused on field veterinarians in Pakistan regarding CCHF. Previous studies in Pakistan were limited to general public and health workers (Nejati *et al*, 2024). According to Jamil *et al* (2022) study among general public, half of the study participants (48.5%) didn't even know about the term "Congo" in contrast to that our Study show that veterinarians have High to Good level of knowledge about causes and transmission of CCHF as comparison to general public. They have good practices to take precautionary measures and standard protective measures for their selves as general public. The study revealed that well-educated participants exhibited better knowledge, attitudes, and practices compared to those with lower levels of education, which aligns with findings from similar research conducted in Turkey (Yilmaz *et al*, 2009).

As education about the disease, its cause and route of transmission is the first step to minimize the prevalence of the disease (Jamil *et al*, 2022). This study reveals that participants with MPhil qualification have higher Mean knowledge score 46% than that of participant's with DVM 42%.

This study revealed that highly experienced participants showed significantly more positive attitudes and better practices, which aligns with previous findings (Ahmed *et al*, 2018). Age correlates with longer experience and familiarity with the disease, potentially contributing to

these outcomes. Possibly this could be the reason that respondents with more than 10 years of experience had higher mean knowledge score as compared to others.
In the urban population studied, there were higher levels of knowledge, positive attitudes, and good practices compared to their rural counterparts. It's important to note that in Pakistan, approximately two-thirds(62%) of the population resides in rural areas (World Bank, 2023), where many individuals who come into direct contact with cattle are often illiterate. Consequently, rural residents may have limited awareness of CCHF, especially if they have not encountered cases in their local communities (Atif *et al*, 2017). Our data indicates that participants residing in urban areas had a higher level of knowledge at 71%, compared to those residing in rural areas, where the knowledge level was 29%.
Duration of the work experience of participants have positive association with the attitude. Participants with 10 or more years of experience show the highest proportion of both high and low attitudes, with 46% in each category. In contrast, participants with 7-9 years of experience exhibit a significant share of low attitudes at 35%, alongside a moderate 17% reporting high attitudes.
Unfortunately, Pakistani healthcare system lacks enhanced and requisite capabilities to meet the challenges of CCHFV epidemics and respond to this severe health concern for several reasons (Smego Jr *et al*, 2004). Some of them are lack of quarantine centers or infection control measures, poor contact tracing measures and lack of trained personnel and or professionals. It becomes paramount that increased consciousness is created for CCHF in the public domain at individual, community, and national levels, since this may change the perception towards CCHF by the people (Jamil *et al*, 2022). Veterinary physicians can initiate public campaigns by offering information concerning the CCHFV through media and interaction with the people. They can educate people on the routes of transmission and the symptoms of CCHFV, encourage people to spray animal folds in order to avoid attacks from ticks, educate people on how to handle and butcher animals safely and encourage the use of protective clothing when cleaning so as to avoid contact with ticks. This information should be provided through seminars, pamphlets and workshops as it is likely to reach more people in rural areas. It is crucial to measure the fundamental knowledge and receptiveness of the community in relation to the disease before embarking on any disease control program (McKenzie *et al*, 2022).
Through such data, the policy makers can formulate specific measures to counter the rise of CCHF in Pakistan. The findings are significant and informative to the Ministry of Health and international organizations in formulating and implementing sound strategic frameworks to control and prevent CCHF outbreaks. Such efforts may include the development of operational and efficient infection control, strengthening of health systems, as well as raising the standard of awareness through applicable educative measures. The described approach can be helpful to lessen the consequences of the CCHF spread and improve the population’s health defense.

Declaration of Competing Interest

The authors declare that they have no competing or conflict of interests.

Author Contributions

SFAS: Conceptualization, Methodology, formal analysis, Writing—original draft preparation. **MA:** Conceptualization, Methodology. **ARR:** Methodology, Formal analysis. **SAD:** Methodology, Formal analysis. **FR:** Formal analysis, Writing—review and editing. **TN:** Formal analysis, Writing—review and editing. All authors have read and agreed to the published version of the manuscript.

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