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Original Article

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Assessing rabies knowledge and practice from a one health lens in healthcare professionals in Sargodha district, Pakistan: A zero by 2030 approach

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ABSTRACT

BACKGROUND & OBJECTIVE: The complex dynamics of rabies transmission make it a public health challenge, especially in an underdeveloped world. The study aims to assess the knowledge and practices of healthcare professionals about the pathogenesis, epidemiology, prevention, and control of rabies through a One Health lens.

METHODOLOGY: A mixed-method study targeting the healthcare professionals practicing in the district of Sargodha, Pakistan, was carried out from 1ST January to 31ST December 2020. A total of 102 participants were purposively enrolled to collect the quantitative and qualitative data. The Chi-square test for categorical variables and binary logistic regression to test associations between variables were used and for qualitative data, thematic analysis was done.

RESULTS: Postexposure Prophylaxis protocol was correctly identified by 21(31.8%) human healthcare professionals, and the association with clinical experience of more than ten years was found to be statistically significant (χ^2=5.657, p=0.017). Veterinary practitioners were almost seven times more likely to support the idea that the One Health approach can help reach zero deaths target from rabies by 2030 compared to human healthcare professionals (OR=6.84, 95%CI 1.31;35.56, p=0.0222). Healthcare providers had reasonable knowledge of rabies pathogenesis, reservoir, mode of transmission, and endemicity; however, they lacked adequate skills for proper animal bite management and treatment. Clinical experience was indirectly proportional to the acceptance of the One Health approach, especially with the mass vaccination of canines.

CONCLUSION: Reiteration and continuing medical education for integrated approaches like One Health is needed for healthcare professionals to bridge the skill gaps and promote collaborative work in the face of challenges experienced during zoonotic diseases.

KEYWORDS: Healthcare Workers, Neglected Tropical Diseases, One Health, Rabies, Zoonoses.

INTRODUCTION

Rabies remains a public health challenge by being one of the most fatal neglected tropical diseases yet preventable it is caused by the Lyssavirus from the family Rhabdovirus [1]. The drive by World Health Organization (WHO) and its partners to achieve "Zero human deaths from dog-mediated rabies by 2030" ensures One Health is underway [1-2].

Rabies affects all mammals (bats, monkeys, Racoons, wolves, jackals, mongooses, skunks, cats, and foxes). World over, the canine transmission of rabies in humans is highest, with 95% of rabies cases transmitted to humans as compared to several other carnivorous animals. Also, the annual human deaths caused by rabies are mainly through canine transmission [3-4]. The World Health Organization (WHO) reported that monkey bites account for 2–21% of animal bite injuries. Rabies transmission in animals and humans occurs mainly by close contact with saliva from infected animals by bites, scratches, and licks on torn or or broken skin and mucosa [2,3].

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According to the Centers for Disease Prevention and Control (CDC), rabies can spread to people from bats after very small minor bites or scratches which might go unnoticed or unrecognized in case of bat exposure; this makes Postexposure Prophylaxis (PEP, which includes vaccination) recommendation for any person with a bite or scratch from a bat unless the bat is available for testing and tests negative for rabies. Well-timed rabies PEP can prevent the devastating consequences of the virus in humans, which has the potential to cause encephalitis and death without PEP[1,3]. Post Exposure Prophylaxis should be considered after direct contact between a person and a bat, even in circumstances when a bite or scratch cannot be confidently ruled out. Rabies is 100% preventable with timely administration of post-exposure prophylaxis to human victims and can be controlled through mass vaccination of domestic dogs, which is quite cost effective [5-6].

Globally the burden of rabies remains high, with occurrence in 150 countries, but Low Middle-Income Countries experience the largest number of rabies cases, including Pakistan [2]. Moreover, with a rank of 11th most deadly infectious disease, rabies cost immense loss of life with 59,000 deaths with estimated costs of 8.6 billion US dollars per year in lost lives, livelihood, and costs of treatment [2,7]. Rabies cases in India are around 30 per million annually, and in Bangladesh, 14 cases per million annually are accounted for the incidence density of human deaths. High incidences of mortality from rabies are reported in Asia (58%) and in South Asia (45%)[8]. In Pakistan, fifty thousand cases of dog bites and 6000 deaths occur annually, highlighting the importance of preventing this disease [4,8]. Rabies cases tend to increase in the summers from dog bites, especially in children. Moreover, monkey bites have also been reported in the capital of Pakistan as monkeys entered the urban area of Islamabad, abandoning Margalla hills in search of food. Currently, Pakistan's health system is strained due to the Covid-19 pandemic and faces critical challenges in answering the WHO call for eliminating dog-mediated human rabies by 2030[4, 8-9].

The barriers hampering the international agenda to eliminate rabies by 2030 in Pakistan are a shortage of vaccines, especially in rural healthcare settings; lack of awareness in the general public about the disease, rabid animals, and prompt treatment; inadequate training of healthcare professionals to deal with cases of dog and other animal bites; lack of knowledge about the administration of rabies vaccines and Rabies Immunoglobulin (RIG)[4, 7-10].

The purpose of the study was to identify the knowledge and skill gaps and explore a One Health driven aspect of the fatal yet preventable communicable disease in the healthcare provider community of Sargodha.

METHODOLOGY

A mixed-method study targeting the Human Healthcare Professionals (HCPs) and Veterinarian Professionals (VPs) of Sargodha, Pakistan, was carried out from 1st January to 31st December 2020. IRB Approval (Letter no. ERC/19/08) to conduct this study was obtained on 7TH May 2019 from the ethical review committee of HITEC-Institute of Medical Sciences under the affili-ation of NUMS (National University of Medical Sciences). Healthcare workers were purposively enrolled from the registered district and sub-district level hospitals also, including a union health facility. The directorate of the Livestock Department Sargodha District was contacted to get da-ta from the veterinarians willing to participate in our study. Validated questionnaires were dis-tributed to licensed physicians and veterinarians in Sargodha District for quantitative data, and face-to-face in-depth interviews were taken for the qualitative data [11-12].

Inclusion and Exclusion Criteria: The healthcare professionals were eligible if they had worked in the facility for over six months; held a license to practice; were willing or agreed to participate in the survey, and agreed to the verbal and written consent proforma. Respondents who had partic-ipated on the previous day were excluded from the interview.

Initially, a total of 71 licensed healthcare professionals (medical doctors, physicians, general practitioners) and 39 veterinarians in Sargodha were enrolled. A total of eight participants were excluded, 3 due to lack of clinical practice in the previous year, and five for not fully completing the questionnaires, yielding 102 respondents who were included in the thematic analysis. In-depth interviews (IDIs) were conducted with 26 participants in Urdu by the first author using an interview guide developed with an extensive literature review by the authors. The interview guide was pretested on five healthcare workers who were not in the final enrolment of the study population. Each interview was audio recorded, lasting 10-15 minutes, and then transcribed by an independent individual, followed by a detailed review of the transcripts. The pre-test helped in refining the research tool and to draw lessons for the final data collection instrument. All the IDIs were audio-recorded and hand-noted.

The first author and independent team translated and transcribed all audio recordings, and the first author and the team proofread the transcripts. Detection of errors of omissions and/or commission was carried out with revisions. Identifiers were given to the animal and human healthcare facilities to remove institutional and personal identifiers. NVivo 11 software was used for analysis. In-depth interviews were done on two occasions with an interval of ten days with the help of interviewers visiting the health facilities for data collection from human and animal healthcare workers who met the eligibility criteria. For the qualitative data through thematic analysis, the respondents were asked about the relevance of the One Health approach for the fight against rabies and the facilitators and barriers in implementing One Health approaches for Rabies in Pakistan.

Quantitative analyses were done using the software package for social sciences SPSS version 27. Chi-square tests were used to test associations between the categorical variables for HCPs and VPs skill-specific variables. A binary logistic

regression modeling was carried out to check the association of covariates of interest, 'speciality by category of Human healthcare and veterinary professionals' and 'years of clinical practice with the dependant variables. The two binary de-pendent variables were 'One Health approach can help achieve the target of Rabies elimination by 2030' and 'canine vaccination for prevalence reduction of rabies'.
Responses were analysed separately for veterinarians and medical/general practitioners. A p-value of ≤0.05 was considered statistically significant.

RESULTS

There were more male respondents 89 (87.2%) than females 13 (12.8%), in a total of 102 participants, with 66 Human Healthcare Professionals (HCPs) and 36 Veterinarian Professionals (VPs), a comparable number of respondents residing in peri-urban 23 (22.5%) and urban 79 (77.5%) areas (Table-I). The results showed that more than 80% of veterinarians and healthcare professionals knew about bats and dogs as the reservoir of rabies.

Cats and raccoons were least correctly identified as reservoirs of rabies. Clinical signs of rabies in animals were correctly identified the VPs than by HCPs. However, 19(52.8%) VPs incorrectly identified hypothermia as a clinical sign of rabies. Transmission routes through the bite of the animal were correctly identified by VPs 33 (91.7%) and HCPs 61 (92.8); however, only 21 (58.3%) VPs and 19 (28.8%) HCPs correctly identified the transmission though a scratch by a feral cat. Rabies free countries were correctly identified by less than fifty percent of respondents. Only 12 (33.3%) VPs and 33(50.0%) HCPs identified New Zealand as rabies-free. Pakistan and India were correctly identified as rabies endemic by the majority. However, only 17 (47.2%) and 33 (50.0%) responded correctly in identifying Canada as rabies endemic (Table-II).

Table-I: Characteristics of respondents.

Independent Variables	Veterinary Practitioners (VP) n=36 n(%)	Human Healthcare Professional (HCP) n=66 n(%)
Years since graduation		
10 years or less	20 (55.6)	33 (50%)
More than 10 years	16 (44.4)	33 (50%)
Frequency practiced clinical medicine in the past 12 months		
At least once per week	32 (88.9)	56 (84.8)
Less than once per week but at least once per month	4 (11.1)	10 (15.2)

Responses from HCPs on specific rabies questions in Sargodha included the requirement of additional PEP or a person already vaccinated for rabies after a confirmed exposure and a total of 26(39.4%) healthcare professionals with combined categories of clinical experience, i.e., less than and more than ten years identified the correct response with a significant association between years of clinical experience χ^2 =9.138, p=0.003.

Table-II: Comparison of Responses to Rabies Knowledge by Healthcare Professionals.

Independent Variables	Correctly identified by VP (n=36) n (%)	Correctly identified by HCP (n=66) n (%)
Most likely rabies reservoirs[a]		
Bat[a]	20 (55.5)	55 (83.3)
Cat[a]	25 (69.4)	37 (56.1)
Dog[a]	36 (100)	64 (97.0)
Pigeon[b]	26 (72.2)	51 (77.2)
Monkeys[a]	26 (72.2)	38(57.6%)
Squirrel[b]	17 (47.2)	52 (78.8)
Clinical signs of rabies in animals		
Unusual aggression[a]	25 (69.4)	47 (71.2)
Difficulty swallowing[a]	30 (83.3)	45 (68.2)
Hypersensitivity to light[a]	25 (69.4)	46 (69.7)
Hypothermia[b]	19 (52.8)	24 (36.4)
Alopecia[b]	26 (72.2)	39 (59.1)
Maculopapular rash[b]	22 (61.1)	47 (71.2)
Transmission routes		
An animal bites a person[a]	33 (91.7)	61 (92)
A feral cat scratches a person[a]	21 (58.3)	19 (28.8)
A person pets a healthy 4-week-old kitten[b]	35 (97.2)	64 (97.0)
A person steps in the faeces of cat[b]	36 (100)	65 (98.4)
Rabies free[a] and endemic[b] countries		
New Zealand[f]	12 (33.3)	33 (50.0)
United Kingdom[f]	12 (33.3)	15 (22.7)
India[e]	33 (91.7)	62 (94.0)
Canada[e]	17 (47.2)	33 (50.0)
Pakistan[e]	36 (100)	66 (100)
No Country is Rabies free[a]	32 (88.9)	23 (34.8)

[a]Correctly identified
[b]Incorrect identified
[f]Rabies Free Country
[e]Rabies endemic Country

Following the PEP protocol, confirmed rabies exposure in unvaccinated persons was reported by a total of 42 (63.6%) healthcare professionals with a significant association of a higher clinical experience (χ^2=12.833, p≤0.001). Requirement of Postexposure Prophylaxis (PEP) when some-one who is too young or unable to communicate contact with the suspected animal, especially like bats whose bite or scratch can go unnoticed due to very small size, was correctly identified as proper examination and PEP by only 21(31.8%) and showed statistical significance associated with a higher clinical experience (χ^2 =5.657, p= 0.017) (table-III).

Table-III: Responses from Human Healthcare Professionals (HCPs) on Specific Rabies Questions in Sargodha-Pakistan.

Statements	Response	graduated ≤10 years ago n (%)	Graduated >10 years n (%)	Chi-square, p-value
Postexposure Prophylaxis (PEP) in a vaccinated person.				
A person already vaccinated for rabies does not need additional PEP after a confirmed exposure	Yes[a]	19 (28.8%)	7 (10.6%)	9.138
	No	14 (21.2%)	26 (39.4%)	(0.003)
Postexposure Prophylaxis (PEP) protocol in an unvaccinated person.				
Clean wound, administer human rabies immune globulin (HRIG), and start rabies PEP vaccine series[a]	Yes[a]	14 (21.2%)	28 (42.4%)	12.833
	No	19 (28.8%)	5 (7.6%)	(≤ 0.001)
Postexposure Prophylaxis (PEP)				
PEP is required when someone is exposed and cannot communicate their contact with the suspected animal, for example, knowledge of the proper protocol for a bat found in the bedroom a sleeping two-year-old boy.	True[a]	6 (9.1%)	15 (22.7%)	5.657
	False	27 (40.9%)	18 (27.3%)	(0.017)
Rabies Postexposure Prophylaxis (PEP) schedule				
Days 0, 3, 7 and 14[a]	Yes[a]	25(38%)	27(41%)	0.364
	No	8 (12.0%)	6(9.0%)	(0.382)
The proper anatomic site of rabies vaccine administration.				
Deltoid areaa	Yes[a]	28 (42.5%)	25 (37.9%)	0.862
	No	5 (7.6%)	8 (12.9%)	(0.269)

Table-IV: Responses from Veterinary Practitioners (VPs) on Specific Rabies Questions in Sargodha-Pakistan

Statements	Response	graduated ≤10 years ago n (%)	Graduated >10 years n(%)	Chi-square, p-value
Proper protocol for a cat vaccinated six months back that bites a person.				
Vaccination to be avoided for rabies, quarantine for 10 days, and observe for the appearance of clinical signs of rabies.	Yes[a]	7 (19.4%)	6 (16.7 %)	0.024
	No	13 (36.1%)	10 (27.8%)	(0.877)
Proper protocol for a dog vaccinated eight months back bitten by a dog.				
Wound cleansing, booster vaccine, quarantine for 45 days, and observation for clinical signs of rabies.	Yes[a]	11 (30.6%)	8 (22.2%)	0.089
	No	9 (25.0%)	8 (22.2%)	(0.515)
Proper protocol for a dog not previously vaccinated and bitten by a fox.				
Immediately euthanise and submit the head for rabies testing.	Yesa	6 (16.7%)	11 (30.6%)	5.355
	No	14 (38.9)	5 (13.9%)	(0.023)

[a]**Correct option**

Responses from VPs on specific rabies questions in Sargodha included Proper protocol for a cat vaccinated 6 months previously that bites a person; a total of 13(36%) respondents from both categories of clinical experience correctly identified a response with no statistically significant association χ^2 =0.024, p=0.877. Proper protocol for an unvaccinated dog bitten by a wild fox requiring immediate euthanising and rabies testing was correctly reported by only 17(47.3%) of veterinary practitioners (Table-Iv).

Most of the HCPs knew about the One Health approach 59(89.3%), and all the VPs (100%) had knowledge of it. Veterinarians were almost seven times more likely to be supportive of the idea that the 'One Health approach can help achieve the target of Rabies elimination by 2030' compared to clinicians (OR=6.84, 95%CI 1.31;35.56, p=0.0222). Based on the clinical experience, those with more than 10 years of clinical experience were less likely to be supportive of the One Health approach compared to those with less than or equal to 10 years of experience (OR=0.09, 95%CI 0.02;0.36, p=0.0006).

Veterinary Professionals were almost 48 times more supportive of the idea that 'canine vaccina-tion can reduce the prevalence of overall rabies' compared to clinicians (OR=48.14, 95%CI 3.4;681.2, p =0.004). Based on the clinical experience, those with more than 10 years of clinical experience were less likely to be supportive of a reduction in the prevalence of rabies with mass canine vaccination compared to those with less than or equal to 10 years of experience (OR=0.03, 95%CI 0.003;0.24, p=0.001).

For the qualitative data, the respondents were asked about the relevance of the One Health ap-proach for the fight against NTDs: barriers to adopting One Health approaches and benefits of implementing One Health for Rabies in Pakistan. For the first question on the relevance of One Health Disease for NTDs, the majority (89%) of the HCPs

and 100% VPs thought that the One Health concept was relevantly significant for the fight against NTDs like rabies and Corona Virus. Three respondents from HCPs reported not at all, and twenty-four HCPs commented on why they thought it was relevant, indicating that rabies is zoonotic in origin and animal-to-human transmission needs to be dealt with by focusing on animals' health. The second common answer response was, "One Health' an approach that tackles the complicated epidemiological situations where human, animal, and environment are involved is interlinked".

The most common reason from 26 respondents (9 from HCP and 17 VPs) was that the focused Neglected Tropical Diseases are zoonoses with animals and the environment acting as reservoirs or sources of contamination for humans. One Health approach, therefore, allowed a more logical understanding of complicated epidemiological cycles with human-animal-environment interactions. Two of the respondents from HCPs mentioned a low prospect of One Health in Pakistan; when asked about the reasons, they mentioned a lack of knowledge and awareness and national commitment.

The response to the statement about barriers and difficulties in implementing One Health approaches for Rabies in Pakistan had very few responses, with only 3 (33%) HCPs commenting on the barriers of implementing One Health approaches for Rabies in Pakistan it and the response was about being not very popular in Pakistan, less promotion, awareness, and integration. However, more than 90% (16) of the VPs responded on it by mentioning lack of resources, multisectoral coordination, and integration efforts.

The statement that explored the benefits of implementing One Health approach for diseases considered neglected like rabies had, almost 98% of the HCPs (8) and VPs (17) responded with the comment that One Health can efficiently target the neglected tropical diseases, especially rabies, as it's a holistic approach and considers animal health as important as human health. The animal origin of zoonotic disease needs to be prioritized while tackling diseases like rabies for national elimination of this disease. The other most common response was interconnection and multisectoral action, which have many benefits.

DISCUSSION

In our study, comparisons were made between human and animal healthcare workers regarding epidemiology, post-exposure prophylaxis, and the One Health approach's relevance to Neglected Tropical Diseases like Rabies.

All the healthcare professionals (100%) knew about rabies, more than 98% of animal and Human Healthcare professionals (HCPs) knew about rabies transmission in humans, and 80% were familiar with the fact that an animal bite by a dog and bat causes rabies. The study conducted in Bangladesh reported 98% HCPs and veterinary professionals (VP) named rabies as the disease caused by an animal bite; however, 84.7% of the clinical practitioners were familiar with the transmission through a bite of an animal [12]. The same study reported human infection of rabies by the majority of the HCPs (95.73%) and VP (76.2%) but lacked knowledge of rabies transmission through undomesticated canines and pets[12]. Bites by domestic animals are very common and a study in Brazil reported 258 dog bites/100,000 persons and 41 cat bites/100,000/year in an annual incidence per state: between 2008 and 2016[13]. In Pakistan non, vaccination of domestic dogs and the proliferation of stray dog population who do not receive vaccination remains a big challenge.

The fatality of rabies was correctly identified by 98% percent of participants as compared to a study conducted by Rana MS et al. where 88.6% HCPs and 91.0% VPs knew about the dead-end infection [12]. Infectivity of rabies in cats (62.75 %) and monkeys (64.9%) on an average, scored low in comparison to canine and bat infectivity with rabies. However, the scores were higher in comparison with a study done in Bangladesh which reported a substantial knowledge gap in HCPs vs VPs about rabies infection in dogs (27.0 % vs 32.7 %) and cats (16.6% vs 23.2%)[12]. In a study conducted in the United States of America, correct identification of the proper protocol when a bat is found in a toddler's room was recorded (86.4% vs 71.2% in HCPs vs VP) in participants who graduated less than or equal to 10 years ago were most likely to answer correctly as compared to our study where respondents who graduated more than ten years ago were more likely to correctly answer the proper protocol of a bat is found in a toddler's room 15 (22.7%)[11]. Clinical signs of rabies in animals were correctly reported by 55.2% of HCPs versus VP (46.6%). The study by Hennenfent AK et al. reported that more than 85% of the HCPs and VP on proper PEP protocol for someone previously vaccinated against rabies[11].

Similar results were observed in our study when compared with the results reported in a recent survey, where overall, veterinarians were more likely to select the correct rabies reservoirs (85.6% vs 78.3%, p=0.4) [11]. The same study reported that more HCPs incorrectly selected squirrels (38.0% vs 13.6%) as rabies reservoir[11]. The same study recorded 25.3% of veterinarians as compared to 19.2% of human healthcare providers correctly identifying rabies-free countries, and more physicians (76.7%) than veterinarians (14.4%) stated that no country is rabies-free, however, in our study 32 (88.9) VPs correctly identified that no country is rabies free [11].

In Human healthcare providers' specific assessment, 79% reported the correct PEP protocol, and the results were almost like the study conducted in the USA where the majority (82%) correctly identified the correct Post Exposure Protocol for rabies exposure in an unvaccinated individual; however, only 49% identified the correct anatomic site of administration which in our study was 92.4% [11]. In a study carried out in Senegal, only 5.3% healthcare providers had skills to manage animal bites and wounds [14].

A recent study conducted in Bhutan highlights the need to improve rabies management policies and national clinician training based on the report that only 71 % of cases went through the rabies risk classification by the WHO, National Rabies Management Guidelines (NRMG). However, information regarding the type of exposure was collected in all the cases [15]. The same study reported 13% of miss classification of rabies exposure by not reporting risk when it catered to moderate to severe risk in independent classification by NRMG[15]. The underestimation of the risk after exposure is documented as a concern, as classification of the risk requires attention to relevant epidemiological information.

The open-ended question about the 'relevance of the One Health approach for the fight against NTDs' in our study received somewhat similar responses when compared with the responses carried out in a study conducted in France with the enrolment of scientists from French-speaking countries with work experience on zoonotic Neglected Tropical Diseases (NTDs)[16]. The vast majority approved the One Health approach, and around two-thirds had already experienced such approaches. The study has reported difficulties encountered while implementing One health, especially when collaborating across multiple sectors and disciplines and obtaining dedicated funding and consistent political support [16]. On the contrary, in our study, only a few HCPs responded by mentioning a lack of knowledge, awareness, and low funding.

More than half of the VP responded by mentioning a lack of resources, multisectoral coordination, and integration. The veterinarian Professionals appeared more knowledgeable and confident about the One Health approach and its impact on zoonotic diseases. The study conducted by Molia S et al. stressed the need for promotion and capacity-building to enhance One health practices and, eventually, the gains that are efficacious and cost-efficient interventions for NTD control and elimination [16].

A study conducted in Uganda revealed gaps that compromise treatment and therapy outcomes affected by varying levels of deviations with inadequate history or verification of the patient history, non-classification of bite wounds, and inadequate counseling of patients at homecare of the wounds [17]. The study also highlighted the stock-outs for immunoglobulins and vaccines and insufficient knowledge and skills on how rabies and dog bite injuries should be treated [17]. Health education regarding the prevention of canine bites is not given to patients due to management and time constraints. However, health education not only helps in treatment outcomes but raises awareness in communities for rabies prevention and control programs [18-20].

The results have shown that VPs were more likely to support the idea that one health integration can help achieve Zero mortality in humans from dog-mediated rabies by 2030 compared to human healthcare professionals. Based on clinical experience, those with more than ten years of clinical experience were less likely to be supportive of one health approach than those with less than or equal to ten years of experience.

It is recommended that eliminating rabies in Pakistan by employing risk assessment, education of the public, and the One Health approach through mass vaccination of dogs is eminent to achieve the global vision of zero human deaths due to rabid dogs by 2030.

CONCLUSION

Human and animal healthcare providers had reasonable knowledge of rabies pathogenesis, reservoir, mode of transmission, and endemicity; however, continuing medical education to ensure proper animal bite management and treatment is recommended to bridge the skill gaps. Reiteration and advocacy for integrated approaches like One Health are needed for healthcare professionals to collaboratively work in the face of numerous challenges experienced during zoonotic diseases.

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Author's Contribution:

Hina Shan: Involved in the conception, design, methodology and statistical analysis of the research proposal.
Saadia Maqbool: Contributed to the data collection and interviews for the qualitative part and the interpretation of results.
Rubab Zulfiqar: Acquisition, analysis, or interpretation of data for the work
Maryam Shan: Contributed to the statistical analysis and manuscript writing.
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