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EDITED BY
Teresa Elizabeth Leslie,
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REVIEWED BY
April Davis,
New York State Department of Health, United States
Waqas Ahmad,
University of Veterinary and Animal Sciences, Pakistan

*CORRESPONDENCE
Maxwell Mabona
Maxwellm@nicd.ac.za

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Knowledge, attitudes, and referral practices regarding animal bites and prevention of human rabies among Traditional Health Practitioners in the eThekwini District in KwaZulu-Natal Province, South Africa, 2022

Maxwell Mabona[1,2,3*], Thembekile Zwane[1], Babongile Mhlongo[4], Lazarus Kuonza[1,2] and Poncho Phafane[4,5]

[1]South African Field Epidemiology Training Programme, National Institute for Communicable Diseases, Johannesburg, South Africa, [2]School of Public Health, Faculty of Health Sciences, University of Witwatersrand, Johannesburg, South Africa, [3]Centre for Emerging Zoonotic and Parasitic Diseases, National Institute for Communicable Diseases, a Division of the National Health Laboratory Service, Johannesburg, Gauteng, South Africa, [4]Communicable Disease and Control Directorate, KwaZulu-Natal Department of Health, Pietermaritzburg, South Africa, [5]Division of Public Health Surveillance and Response, National Institute for Communicable Diseases, Johannesburg, South Africa

Background: South Africa experiences approximately 10 human rabies deaths annually, despite the availability of effective post-exposure prophylaxis (PEP). In KwaZulu-Natal Province, one of the most rabies-affected provinces, many animal bite patients initially seek help from Traditional Health Practitioners (THPs) before considering conventional healthcare facilities. Prompt referral of animal bite patients for PEP initiation by THPs can be lifesaving. Our study aimed to assess the knowledge, attitudes, and referral practices regarding human rabies and the associated factors among THPs in eThekwini District, KwaZulu-Natal.

Methods: A cross-sectional study was conducted among registered THPs in eThekwini District, collecting data through a structured, standardized questionnaire. The questionnaire was administered through physical and telephone interviews. We described socio-demographic characteristics using summary statistics. Multivariable logistic regression was used to analyze factors associated with knowledge, attitudes, and referral practices. Odds ratios (OR) were used with 95% confidence intervals, and a probability (p)-value of ≤0.05 was considered statistically significant.

Results: The study involved 204 THPs, with 74% (150/204) being female. The median age was 43 years (inter-quartile range: 22–75 years) and 31% (64/204) had over 10 years of practicing experience. The majority of THPs had inadequate knowledge (80%, 163/204), and poor referral practices (73%, 149/204). However, 91% (186/204) had positive attitudes toward human rabies prevention. Having more experience was associated with adequate knowledge (p<0.01), and positive

attitudes (p=0.02). THPs who had adequate knowledge (aOR:2.30 95% CI: 1.12-4.75) and positive attitudes (aOR:1.21 95% CI: 0.37-3.89), had higher odds of having good referral practices.

Conclusion: Despite THPs in the eThekwini District having positive attitudes towards rabies prevention, gaps exist in their knowledge and referral practices. The study highlights that improving their knowledge and attitudes might lead to better referral practices of animal bite patients for PEP initiation. A multidisciplinary approach that includes THPs is recommended to decrease human rabies deaths in eThekwini District and KwaZulu-Natal Province.

KEYWORDS

animal bites, human rabies, Traditional Health Practitioners, post-exposure prophylaxis, KwaZulu-Natal

Introduction

Human rabies is a devastating neglected tropical disease that is reported to kill one person every nine minutes globally (1). The fatal viral infection commonly spreads to humans through contact with the saliva of infected animals (2, 3). Although all mammals can be infected with rabies, over 99% of human cases and deaths in developing countries are dog-mediated (1, 4). Despite being vaccine-preventable, human rabies remains a significant global public health issue, causing around 59–000 deaths annually (1). Approximately 80% of human rabies cases occur in rural areas of developing countries, with 40% of global deaths among children under 15 years old (1, 5). Low and middle-income subtropical African countries are significantly affected by human rabies, accounting for 44% (24 000) of annual global human rabies deaths (1, 6).

Poor preclinical animal bite management and lack of seeking post-exposure prophylaxis (PEP) in South Africa contribute to the ongoing public health issue of human rabies (7–10). Between 2018 and 2021, South Africa recorded 53 laboratory-confirmed human rabies cases (7–9). The majority of these cases were from the KwaZulu-Natal (KZN) Province (46%), followed by the Eastern Cape (37%) and Limpopo (15%) Province (8, 9). Although community rabies awareness and mass dog vaccination campaigns in the KZN Province have helped decrease human rabies cases, the province continues to report a disproportionate number of human rabies cases (11–13). The eThekwini District in KZN has been the primary location for most cases, accounting for 75% of laboratory-confirmed cases in South Africa in 2020 and 62% between January 2020 and July 2021 (7–9).

South Africa is among the member states committed to the goal of eliminating dog-mediated human rabies deaths by 2030, set by the World Health Organization (WHO), the World Organisation for Animal Health (WOAH), and other global partners (14). The strategic elimination plan aims to achieve this by enhancing affordability, access, and timely administration of PEP (1, 14). In exposed individuals, WHO's preclinical guidelines recommend washing animal bite wounds with running water for 15 minutes, disinfecting with soap or disinfectants, and seeking immediate medical care for PEP (1, 15). Timely and appropriate administration of PEP is almost 100% effective in preventing human rabies mortality (16). Despite the availability of free PEP in South Africa, the country still experiences delays or no PEP initiation and records about 10 human rabies deaths every year (5, 8, 9).

Human rabies case reports in the KZN Province and the eThekwini District show frequent non or late presentation for PEP by animal bite patients (10). Similar to other African countries, animal bite patients especially in rural settings initially seek treatment from Traditional Health Practitioners (THPs) (17–19). They then consider conventional healthcare facilities as their last option, usually presenting with advanced clinical symptoms (18, 19). Seeking health-related care from THPs is one of the most common practices in South Africa and Sub-Saharan Africa (20, 21). Almost 80% of primary healthcare needs in Africa are met through traditional health practices (21). THPs are usually more accessible, less expensive, and trusted, and provide an explanation of the illness in a more relatable way using the local language (15, 17, 18). THPs are crucial in primary healthcare, particularly in rural areas, providing preclinical management, referrals, and rabies education if knowledgeable and willing (20, 22).

THPs in South Africa are recognized as vital stakeholders in primary healthcare and practice under one regulatory body, known

Abbreviations: WHO, World Health Organization; SA, South Africa; KZN, KwaZulu-Natal; KAP, Knowledge, Attitudes, and Practices; THP, Traditional Health Practitioners; PEP, Post-exposure Prophylaxis; DoH, Department of Health; VIF, Variation Inflation Factor; OR, Odds Ratios; aOR, Adjusted Odds Ratios; IQR, Interquartile Range; SD, Standard Deviation; CI, Confidence Interval; REDCap, Research Electronic Data Capture.

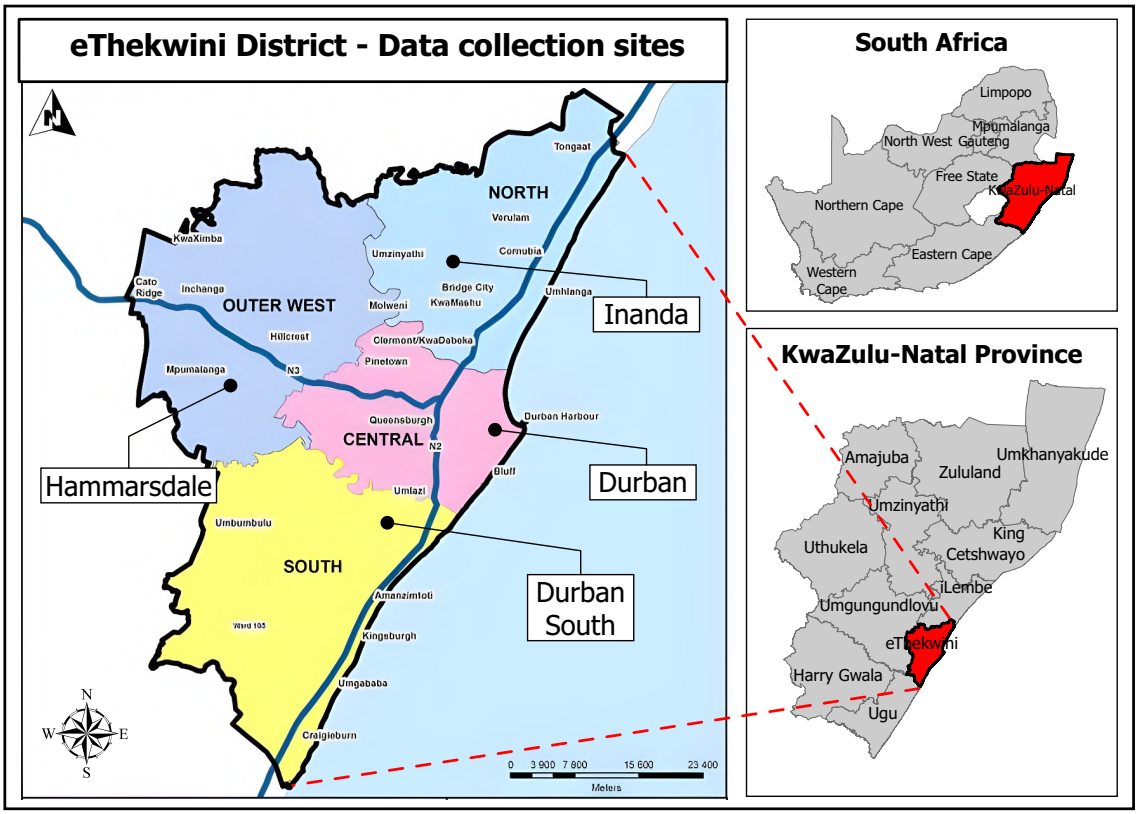

FIGURE 1
Map of eThekwini District, KwaZulu-Natal Province, South Africa, showing data collection sites where Traditional Health Practitioners gathered for physical interviews.

as the Traditional Practitioners Council of South Africa (23, 24). The South African government through the National Department of Health (DoH) has also taken great strides in incorporating THPs into the healthcare system to improve healthcare access and resources (24). Local studies revealed their crucial role in managing HIV/AIDS, particularly in rural areas, through patient screening, referral, and education (20).

Formal educational interventions can significantly increase the referral rate between THPs and conventional healthcare facilities, ensuring a viable referral system between the two (25). A similar approach can be taken with human rabies through educating and incorporating THPs into primary healthcare for early PEP access and initiation. However, not much is known about their knowledge, attitudes, and referral practices regarding animal bites and rabies prevention.

There are currently no studies conducted in South Africa that assess the knowledge levels and perceptions of THPs regarding human rabies. Very little is known about how they manage animal bite wounds and if they are willing to refer patients to conventional health facilities for PEP. The study aimed to undertake a knowledge, attitudes, and referral practices (KAP) survey among THPs in eThekwini District. The assessment would help understand the educational needs of local THPs and their willingness to collaborate and refer animal bite patients. Understanding their knowledge levels and awareness will also allow educational interventions to be modified, tailored, and made more effective. A good referral relationship between conventional healthcare facilities and THPs who are knowledgeable on rabies and its prevention might help with early detection and referral of patients for prompt PEP initiation.

Methods

Study design

We conducted a primary study that employed an analytical cross-sectional study design.

Study setting

We conducted the study in eThekwini District, KZN Province, South Africa (Figure 1). KZN is an eastern coastal province with the 2nd biggest population in South Africa (26). It is divided into 11 districts and eThekwini is one of them. The district is roughly divided into four spatial regions (Central, North, South, and West) consisting of rural, semirural, and urban areas (26). The eThekwini District is the most populated in KZN, with an estimated population of 3 987–648 people, composed largely of the Zulu ethnic group (27).

Study population

The study involved all THPs who consult patients in the eThekwini District, registered on the district's THP association database. The database had approximately 2–000 registered THPs divided into four categories of practitioners which included herbalists (Izinyanga), diviners (Izangoma), traditional birth attendants (Ababelethisi), and faith healers (Abaprofethi or Abathandazi). All the THPs in the eThekwini's THP association database were eligible for sampling.

Inclusion and exclusion criteria

The study included consenting THPs aged 18 years and above who were registered under eThekwini's THPs association. The study also included THPs who are still being trained under experienced supervision (Amathwasa), and consulting patients, while traditional birth attendants (Ababelethisi) were excluded as they do not typically consult animal bite patients.

Sample size

The sample size was estimated by considering 50% of the THP population knowing about rabies since there was no previous study about rabies among THPs in the area. We used eThekwini's registered THP population (1 500, approximately 500 traditional birth attendants (Ababelethisi) excluded), a 95% confidence interval, and a 5% margin of error to calculate the sample size. Our required minimum sample size was calculated using the modified Cochran's Formula to be 307 THPs (28). Factoring in for a non-response rate of 20%, the study aimed to interview 384 THPs (Supplementary File 1).

Sampling strategy

Respondents were selected using the convenience sampling method. This was by including all THPs who were available during the data collection period (June to July 2022), and gave consent to respond to the questionnaire to maximize the response rate.

Data collection method

Before signing the consent form (Supplementary File 2), participants were provided and read a study information sheet (Supplementary File 3) to understand the study's purpose and objectives. We collected data using a structured standardized questionnaire (Supplementary File 4). The questionnaire comprised socio-demographic, knowledge, attitude, and referral practice questions. The questionnaire was adapted from a tool previously used during a THP KAP study on rabies in Ethiopia and modified (29). The Research Electronic Data Capture (REDCap) web application was utilized for developing the questionnaire, collecting and storing data, allowing responses to be collected both online and offline (30). Tablets installed with REDCap were used by the researchers to record participants' responses.

We administered the questionnaires through physical interviews conducted and led by the researcher. The THPs association assisted in convening data collection gatherings in four different sites in each of the four spatial regions (Figure 1). THPs were invited to the gatherings by THPs from the association responsible for each spatial region. THPs who could not attend the physical data collection gatherings were interviewed by telephone. The questionnaire, consent form, and information sheet were available in isiZulu (the local language) and English to ensure understanding. The isiZulu versions of the documents were validated by an independent isiZulu speaker, reader, and writer from the health department.

Data management and analysis

The responses were reviewed for errors, duplicate entries, and inconsistencies using REDCap's unique anonymous participant identifiers. We then imported the data from the questionnaires into STATA statistical software (Version 17) for cleaning and analysis. Data cleaning and management on STATA statistical software included creating, labeling, and renaming variables, and looking for and dropping duplicates. We used STATA for data analysis per objective. Firstly, we performed descriptive analysis using summary statistics to describe the socio-demographic characteristics of the THPs.

Secondly, we allocated scores to the answers for the knowledge, attitude, and referral practice (KAP) section of the questionnaire. We calculated the KAP scores by giving a score of "0" for an incorrect and "1" for a correct answer. The highest possible score was 14 for knowledge, five for attitudes, and six for referral practice questions. We only assigned a score to respondents who answered all questions for that section. We used South Africa's national guidelines for the prevention of rabies in humans to score knowledge, attitude, and referral practice answers as correct or incorrect. The scores were summarized using means with their standard deviations. To create binary variables, KAP scores equal to or above 60% were considered adequate knowledge, positive attitude, and good referral practices and otherwise for those less than 60%.

Thirdly, we categorized and considered the socio-demographic variables as explanatory variables against each of the binary outcomes of knowledge, attitude, and referral practice variables, respectively. The binary knowledge and attitude variables were also used as explanatory variables against the referral practice variable as an outcome. We used Pearson's chi-square test to assess the association between socio-demographic factors and binary KAP variables. We also used Pearson's chi-square test to assess for association between the binary knowledge and attitudes variables and the binary outcome of the referral practice variable.

The study employed an automatic backward elimination method to exclude non-significant predictor variables, ensuring only those with a p-value below 0.2 were included in the multivariable analysis. A multivariable logistic regression was conducted on knowledge, attitudes, and referral practices, adjusting for explanatory variables and all other variables simultaneously. Highly correlated variables were not entered in the multivariable model, a variation inflation factor (VIF) of > 10 was used to indicate multicollinearity. Variables with a probability (p)-value of ≤ 0.05 were considered statistically significant in the multivariable analyses. To display results, we used bar graphs and tables. The tables included odds ratios (OR) and adjusted OR, with their corresponding 95% confidence intervals (CI) and p-values.

Results

A total of 204 THPs were interviewed (66% of target sample size). The median age of THPs was 43 years (inter-quartile range (IQR): 22–75 years) and 74% (150/204) were females. The majority of the THPs categorized themselves as Izangoma (Diviners) (51%, 105/204), followed by Izinyanga (Herbalists) (28%, 57/204), and Abaprofethi or Abathandazi (Faith healers) (21%, 42/204). Most (78%, 160/204) of the THP's practices were located in a rural/semi-rural area (underdeveloped countryside areas away from the city) (Table 1).

Slightly above a third (35%, 72/204) of the THPs had been practicing for 5–10 years. The median number of consultations done by the THPs was four patients (IQR: 2–5 patients) per day. The study found that 46% (94/204) of the THPs (94/204) had secondary schooling, followed by 32% (65/204) with primary schooling and 10% (20/204) with tertiary education. Over half of the respondents (56%, 115/204) were unemployed and solely reliant on income from their THP practices. Among the total interviewed, only seven (3%) previously attended a formal Department of Health rabies training.

Knowledge about rabies

The majority (92%, 187/204) of THPs had heard of rabies before, and 87% (178/204) of THPs were aware of the cause of rabies. Seventy-six percent (155/204) of THPs were able to give at least one sign or symptom of rabies in humans. The THPs scored a mean score of 2.80 (standard deviation (SD): 2.23) out of nine possible common signs and symptoms. Only 26% (53/204) of THPs correctly answered that rabies is not curable. More than three-quarters (76%, 156/204) knew that there is a vaccine to prevent illness after an animal bite, and 89% (182/204) knew that rabies is deadly. Overall, the interviewed THPs scored a mean knowledge score of 6.50 (SD: 2.61) out of a total of the 14 points possible (Table 2).

TABLE 1 Socio-demographic characteristics of Traditional Health Practitioners interviewed during the human rabies KAP study in eThekwini District, KwaZulu-Natal, 2022.

Socio-demographic characteristics of THPs	Frequency (n)	Percentage (%)
Sex		
Male	54	26
Female	150	74
Age		
18-29	33	16
30-39	56	27
40-49	48	24
50-59	23	11
60-69	32	16
>70	12	6
Location of practice		
Rural/semirural	160	78
Urban	44	22
Category of THP		
Izinyanga (Herbalist)	57	28
Izangoma (Diviners)	105	51
Abaprofethi/Abathandazi (Faith healers)	42	21
Number of years practicing as a THP		
<5 years	68	34
5–10 years	72	35
>10 years	64	31
Number of patients seen daily		
≤5	162	79
>5	42	21
Highest formal education level*		
No formal education	25	12
Primary education (Seventh grade and less)	65	32
Secondary education (Eighth grade to Matric)	94	46
Tertiary education and higher	20	10
Employment status		
Unemployed	115	56
Employed	52	26
Self-employed	37	18

(Continued)

TABLE 1 Continued

Socio-demographic characteristics of THPs	Frequency (n)	Percentage (%)
Previous DoH rabies training attendance		
Yes	7	3
No	197	97

THP, Traditional Health Practitioner; DoH, Department of Health; n, number.
*Matric refers to the highest grade in high school, Tertiary education includes college, and university.

Attitudes towards rabies

Only 46% (93/204) of the THPs responded that they felt safe when consulting patients with a history of an animal bite. The majority (90%, 184/204) deemed rabies a dangerous disease, but only 63% (129/204) supported the killing of a stray dog bitten by someone. Almost 90% (182/204) agreed that the vaccination of animals against rabies is important, and 88% (180/204) revealed that they are open to working with the DoH to reduce the incidence of human rabies in eThekwini District. Overall, the THPs scored a mean attitude score of 3.76 (SD: 1.04) out of a total of the five points possible (Table 2).

Rabies referral practices to conventional healthcare

When asked about what they do or would do when an animal bite patient presents to them, 77% (158/204) of THPs gave answers that included an urgent referral to a hospital/clinic. Amongst these answers, 92% (146/158) opted for exclusive urgent referral, and 8% (12/158) opted for treating the wound with traditional medicine

TABLE 2 Knowledge, attitudes and referral practice scores regarding human rabies among Traditional Health Practitioners in eThekwini District, KwaZulu-Natal, 2022.

Frequency of THPs who correctly answered questions	Frequency (%)*	Mean score	SD
Knowledge			
Have you ever heard of rabies before? [1]	187 (92)	0.92	0.27
What causes rabies? [1]	178 (87)	0.87	0.33
What are the signs and symptoms of human rabies? [9]	155 (76)	2.80	2.23
Is rabies curable? [1]	53 (26)	0.26	0.43
There is a vaccine to prevent rabies after an animal bite [1]	156 (76)	0.76	0.43
Can rabies kill a person? [1]	182 (89)	0.89	0.31
Total score possible for section [14]		6.50	2.61
Attitudes			
I feel safe consulting patients with a history of an animal bite [1]	93 (46)	0.45	0.49
Rabies is a dangerous disease [1]	184 (90)	0.90	0.29
A stray dog that bites someone should be caught and killed [1]	129 (63)	0.63	0.78
It is important to vaccinate animals against rabies [1]	182 (89)	0.89	0.31
I am open to working with the DoH to reduce rabies deaths in the district [1]	180 (88)	0.88	0.32
Total score possible for section [5]		3.76	1.04
Referral practices			
What do/would you do when someone presents with a history of an animal bite? [1]	158 (77)	0.77	0.41
Have you ever referred an animal bite patient to the clinic or hospital? [1]	60 (29)	0.29	0.45
Do you normally ask animal bite patients about their rabies vaccination status when presenting to your practice? [1]	70 (34)	0.34	0.47
I use traditional medication ONLY to help patients who present with an animal bite history [1]	34 (17)	0.16	0.37
I normally wash patient's bite wounds with soap and water [1]	95 (47)	0.46	0.50
I normally encourage animal bite patients to finish their course of rabies vaccines at the hospital [1]	165 (81)	0.80	0.39
Total score possible for section [6]		2.85	1.12

*Table only includes frequencies and percentages of THPs who gave a positive response (agree/yes) for each question. The total number of responses received is given when a question is not binary (agree/disagree).
The total score possible for each response is indicated in square brackets.
THP, Traditional Health Practitioner; SD, Standard deviation; DoH, Department of Health.

(roots, herbs, seeds, flowers, animal products) before referring. The remaining (23%, 46/204) opted for treating with traditional medicine only (20% 40/204) or sending the animal bite patient to a nearby pharmacy (3%, 6/204).

Only 29% (60/204) of the THPs had ever referred an animal bite patient to a healthcare facility. Seventeen percent (34/204) reported that they only use traditional medicine to help the patients. Nearly half (47%, 95/204) reported normally washing bite wounds with soap and water, but more than two-thirds (81%, 165/204) reported encouraging patients to finish their course of PEP. Overall, the THPs scored a mean practice score of 2.85 (SD: 1.12) out of a total of six points possible (Table 2).

Overall status of knowledge, attitudes, and referral practices towards rabies

Figure 2 below shows the frequency distribution of THPs scores for each area the questionnaire assessed. The results show that most THPs (80%, 163/204) did not have adequate knowledge (scored below 60%) on rabies. Furthermore, most THPs (73%, 149/204) had poor (scored below 60%) rabies referral practices. However, the majority (91%, 186/204) had positive (scored above 60%) attitudes toward human rabies and its prevention.

Association between THP socio-demographic characteristics and knowledge, attitudes, and referral practices

This study found a significant association between THP's sex and attitudes, with females having a positive attitude (94%) compared to males (83%). There was also a statistically significant (p=0.016) association between the category of the THP and their attitudes. Izangoma had more positive attitudes (96%) compared to Izinyanga (88%) and Abaprofethi or Abathandazi (83%). (Table 3).

THPs with over 10 years (98%) of practicing experience had significantly more positive attitudes compared to those with less than five years (90%), and those with five to ten years of experience (86%) at a statistically significant (p=0.036) level. Similarly, the study found a marginal (p=0.076) association between the number of years in practice and rabies knowledge. THPs who practiced for more than 10 years (28%) had adequate knowledge compared to those who had practiced for less than five years (21%) and five to ten years (13%).

The employment status of THPs was associated with their knowledge with marginal significance (p=0.052). THPs who were employed (31%) had adequate knowledge compared to those who were unemployed (18%) or self-employed (11%). Lastly, this study found a marginal association between previous DoH rabies training attendance and referral practices, with 57% of THPs who have previously attended having good referral practices compared to 26% who had not attended.

Multivariable analysis

We included the category of THP, number of years practicing, and employment status in the final model as predictors of knowledge. Adjusting for the other variables, the multivariable analysis showed that the odds of having adequate rabies knowledge were 4.13 times higher for THPs who have practiced for more than 10 years than they were for THPs who practiced for five to 10 years (aOR: 4.13 95% CI: 1.52-11.21). THPs who were employed had almost four times higher odds of having adequate knowledge than those who were self-employed (aOR: 3.74 95% CI:1.03-13.57).

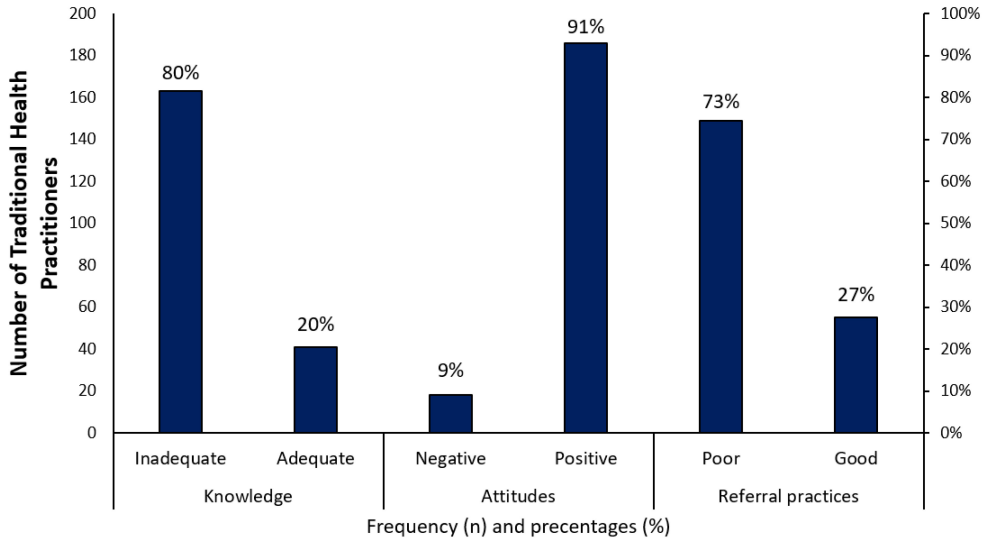

FIGURE 2
Overall scores indicating knowledge, attitudes, and referral practices among Traditional Health Practitioners in eThekwini District, KwaZulu-Natal, 2022.

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TABLE 3 Test of associations between Traditional Health Practitioners socio-demographic characteristics and knowledge, attitudes, and referral practices towards human rabies (n=204).

Socio-demographic characteristics	Knowledge		Attitudes		Referral practices	
	Adequate(%*)	P-value	Positive(%*)	P-value	Good(%*)	P-value
Sex						
Male	8 (15)	0.259	45 (83)	**0.025**	15 (28)	0.875
Female	33 (22)		141 (94)		40 (27)	
Age						
40 years and younger	18 (19)	0.755	82 (87)	0.066	24 (26)	0.671
Above 40 years	23 (21)		104 (95)		31 (28)	
Location of practice						
Rural/semirural	32 (20)	0.947	145 (91)	0.769	45 (28)	0.475
Urban	9 (20)		41 (93)		10 (23)	
Category of THP						
Izinyanga (Herbalist)	8 (14)	0.391	50 (88)	**0.016**	16 (28)	0.489
Izangoma (Diviners)	23 (22)		101 (96)		25 (24)	
Abaprofethi/Abathandazi (Faith healers)	10 (24)		35 (83)		14 (33)	
Number of years practicing as a THP						
<5 years	14 (21)	**0.076**	61 (90)	**0.036**	18 (26)	0.379
5–10 years	9 (13)		62 (86)		16 (22)	
>10 years	18 (28)		63 (98)		21 (33)	
Patients seen in a day						
≤5	31 (19)	0.501	146 (90)	0.377	45 (28)	0.606
>5	10 (24)		40 (95)		10 (24)	
Highest formal education level						
No formal education	5 (20)	0.990	24 (96)	0.704	4 (16)	0.187
Formal education	36 (20)		162 (91)		51 (28)	
Employment status						
Unemployed	21 (18)	**0.052**	107 (93)	0.438	28 (24)	0.354
Employed	16 (31)		47 (90)		18 (35)	
Self-employed	4 (11)		32 (86)		9 (24)	
Previous Department of Health rabies training attendance						
Yes	3 (42)	0.146	7 (100)	1.000	4 (57)	**0.086**
No	38 (19)		179 (90)		51 (26)	

*Table only includes percentages of THPs who had adequate knowledge, positive attitudes, and had good referral practices within each level of the covariates.
THP, Traditional Health Practitioner; DoH, Department of Health; Bolded p-values are significant or marginally significant.

The variables; sex, category of THP, and number of years practicing were included in the final model as predictors of attitude. Adjusting for the other variables, a significant association was found between years of practice and attitude. Over 10 years of THP practice resulted in a 12.6 times higher likelihood of having a positive attitude towards rabies prevention compared to those who practiced for 5–10 years. (aOR:12.62 95% CI:1.49-106.61) (Table 4).

The number of years practicing, highest formal education, employment status, and previous DoH rabies training attendance were the variables included in the final model to predict referral practices. Adjusting for the other variables, THPs who had practiced for more than 10 years also had 2.29 higher odds of having good referral practices than their counterparts (aOR:2.29 95% CI:0.97-5.37), although marginally significant (p=0.057).

Assessing the goodness of fit using the Hosmer-Lemeshow goodness of fit test showed that the knowledge and referral practice models were a good fit to data with p>0.05. However, the attitude model was not of good fit for data with p<0.01.

Association between THPs knowledge, attitudes and referral practices

THPs with sufficient knowledge of rabies had 2.33 times higher odds of good referral practices compared to those with inadequate knowledge (OR:2.33 95% CI: 1.13-4.78). Furthermore, a positive rabies attitude significantly increased referral practices compared to negative attitudes (OR:1.32 95% CI: 0.41-4.20), although not significant with a confidence interval that spanned one (Table 5).

TABLE 5 Univariate analysis of Traditional Health Practitioners' knowledge, and attitudes against referral practices towards human rabies (n=204).

			Referral practices	
Variable	Category	Frequency (%)	OR (95% CI)	P-value
Knowledge	Inadequate	163 (80%)	Ref.	
	Adequate	41 (20%)	2.33 (1.13-4.78)	**0.021**
Attitudes	Negative	18 (9%)	Ref.	
	Positive	186 (91%)	1.32 (0.41-4.20)	0.636

OR, Odds ratio; CI, Confidence interval; Ref, Reference group.
Bolded p-values are significant or marginally significant.

TABLE 4 Multivariable analysis of Traditional Health Practitioners' socio-demographic characteristics and knowledge, attitudes, and referral practices towards human rabies (n=204).

Socio-demographic characteristics	Knowledge		Attitudes		Referral practices	
	aOR (95% CI)	P-value	aOR (95% CI)	P-value	aOR (95% CI)	P-value
Sex						
Male			Ref.			
Female			2.24 (0.75-6.69)	0.148		
Category of THP						
Izinyanga (Herbalist)	Ref.		Ref.			
Izangoma (Diviners)	2.25 (0.85-5.91)	0.100	4.26 (0.97-18.70)	0.055		
Abaprofethi/Abathandazi (Faith healers)	2.21 (0.67-7.24)	0.190	1.04 (0.26-4.09)	0.951		
Number of years practicing as a THP						
5–10 years	Ref.		Ref.		Ref.	
<5 years	1.14 (0.42-3.04)	0.787	1.19 (0.36-3.86)	0.766	1.05 (0.46-2.41)	0.890
>10 years	4.13 (1.52-11.21)	**0.005**	12.62 (1.49-106.61)	**0.020**	2.29 (0.97-5.37)	**0.057**
Highest formal education level						
No formal education					Ref.	
Formal education					2.65 (0.79-8.92)	0.114
Employment status						
Self-employed	Ref.				Ref.	
Unemployed	1.22 (0.36-4.05)	0.745			0.86 (0.34-2.17)	0.765
Employed	3.74 (1.03-13.57)	**0.045**			1.62 (0.59-4.46)	0.348
Previous Department of Health rabies training attendance						
No					Ref.	
Yes					3.07 (0.60-15.50)	0.174

AOR, Adjusted odds ratio; Ref, Reference group; THP, Traditional Health Practitioner; DoH, Department of Health; Table only includes variables not eliminated through automatic backward elimination set at p<0.2.
Bolded p-values are significant or marginally significant.

Discussion

Our study assessed the knowledge, attitudes, and referral practices regarding animal bites and human rabies and the associated factors among THPs. The study found that most of the THPs had inadequate knowledge (80%) of human rabies and poor referral practices (73%) of animal bite patients. Most (91%) of the THPs had positive attitudes towards human rabies prevention. The study found that adequate knowledge, positive attitudes, and good referral practices were associated with longer experience as a THP and employment. Furthermore, good referral practices of animal bite patients to conventional healthcare facilities for PEP are linked to adequate knowledge and positive attitudes.

More than 87% of THPs in eThekwini were aware that dogs were common transmitters of rabies, however, they did not know that there is no treatment for human rabies after symptom onset. These findings were similar to studies done in Ethiopia and India (29, 31). The THPs in India believed that they can cure rabies or it can be cured by the rabies Goddess (31). The THPs included in the study on average were unable to list more than three signs and symptoms which remarkably lowered their knowledge scores. The inadequate knowledge of the clinical features of rabies was also observed among general community members, healthcare workers and students in South Africa and other African countries (4, 32–36). These findings might be due to the lack of training on rabies by health departments, proven by the finding that only three percent of the THPs in this study had previously attended a rabies training. Factors that were significantly associated with adequate knowledge were being employed and having practiced for more than ten years.

Most THPs (90%) had positive attitudes toward dog vaccinations as a method to prevent rabies. This is contrary to the Indian study amongst THPs who were against the vaccination of dogs against rabies (31). The objection against vaccination was based on the belief that vaccines contradict the natural protection of the Goddess against rabies (31). Most of the THPs in eThekwini were willing to collaborate with the health department to reduce rabies mortality. Three other studies done in South Africa show that most THPs have positive attitudes towards a collaborative relationship with conventional healthcare (23, 37, 38). These were also the findings of studies that interviewed THPs in Kenya and Ethiopia (21, 39, 40). The THPs in these two studies were also willing to work hand in hand with the health department (21, 39, 40). This study also found that having practiced for over ten years significantly predicts positive attitudes. Despite the positive attitudes and willingness to collaborate, the study THPs (73%) had poor overall referral practices of animal bite patients. Very few THPs reported having referred an animal bite patient to a healthcare facility for PEP. Additionally, less than half of them usually wash animal bite wounds with soap and running water, while washing and disinfecting wounds can prevent about one-third of rabies infections (16). Experience (more years of practice) as a THP is crucial for good referral practices, as experienced THPs have seen more cases over the years, leading to favorable practices. Although not statistically significant, the study showed that the odds of having good referral practices were increased amongst THPs with adequate knowledge or positive attitudes. This suggests that improving THP's knowledge and attitudes towards human rabies may lead to better referral practices. This is congruent to previous rabies KAP studies that have demonstrated a direct correlation between knowledge, attitudes, and improved practices, which ultimately improves health outcomes (33, 41). Unlike socio-demographic characteristics that are not easily modifiable, educational interventions can significantly enhance the knowledge and attitudes of THPs.

The study was not without limitations. The total number of THPs interviewed did not meet the targeted sample size, potentially limiting the statistical power and contributing to some non-significant associations and wide confidence intervals. The cross-sectional study design chosen provided only a snapshot of THPs' knowledge, attitudes, and referral practices. While this design allows for assessing associations between variables, it does not establish causality. The regression analysis also adjusted for confounding blindly (by using multivariate models). Lastly, since the study was only conducted in one of 11 districts of the province, the generalizability of the findings may be limited. Although these limitations may threaten the validity of the study findings, the study was not intended to be exhaustive but can rather be used as a preliminary investigation of the topic.

Conclusion

THPs are crucial in primary healthcare as animal bite patients usually seek healthcare from them before conventional healthcare facilities. Although they have good attitudes towards rabies, this study has shown that gaps exist in their knowledge, and referral practices in eThekwini District. It has also shown that improving their knowledge and attitudes might lead to better referral practices of animal bite patients for PEP. Lastly, this study indicates that THPs in the eThekwini District are open to collaborating with conventional health to decrease human rabies deaths. Continuous formal training on rabies and its prevention is necessary, in that way, THPs can also serve as trusted stakeholders that educate their patients about rabies, especially in rural areas. A multidisciplinary approach that includes THPs is needed to control and possibly eliminate dog-mediated rabies by 2030.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by University of the Witwatersrand Health Research Ethics Committee (M220123) (Supplementary File 5). The studies were conducted in accordance with the local legislation and institutional requirements

(Supplementary Files 6-8). The participants provided their written informed consent to participate in this study.

Author contributions

MM: Data curation, Formal analysis, Investigation, Methodology, Project administration, Software, Visualization, Writing – original draft, Writing – review & editing. TZ: Data curation, Formal analysis, Methodology, Software, Supervision, Writing – original draft, Writing – review & editing. BM: Conceptualization, Funding acquisition, Investigation, Project administration, Resources, Writing – original draft, Writing – review & editing. LK: Conceptualization, Formal analysis, Funding acquisition, Resources, Supervision, Validation, Writing – original draft, Writing – review & editing. PP: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Generative AI statement

The author(s) declare that no Generative AI was used in the creation of this manuscript.

Publisher's note

Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fitd.2025.1542614/full#supplementary-material

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