Community Knowledge, Attitude and Practice on Rabies, Incidence in Humans and Animals and Risk Factors to Rabies in Selected Districts of Tigray Region, Ethiopia

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SUMMARY
Community awareness and assessing the trend of suspected rabies cases play a significant role in preventing its fatality. Therefore, a cross-sectional study design was employed (October 2016 - April 2017) to assess community knowledge, attitude and practice (KAP), and Incidence and risk factors to rabies (human and animal) in the study area. A semi-structured questionnaire was employed to collect required information from 1440 study participants. Retrospective data of five-year (2012-2016) from hospitals and health centers (human cases), and veterinary clinics (animal cases) was used. Majority of the study participants (64.3%) were rural residents, 95.2% have heard about rabies and 50.1% were found dog owners. Among the study participants, 72.2%, 66.0%, and 62.4% have a good level of knowledge, attitude, and practices about rabies, respectively. A strong association between knowledge, attitude and practice with sex; educational level; occupation, dog ownership and rural/urban dwellers (p<0.05) was recorded. Furthermore, a total dog bite cases of 398 domestic animals and 4617 humans were found registered on casebooks of both veterinary and human health service centers of the study districts during the five years study period among which the highest percentage (36.4%) was recorded from canines. The highest anti-rabies vaccine coverage recorded was 36.0% in the year 2016, and higher human dog bite cases recorded was 50.1% on individuals aged between 5-15 years (both male and female). Hence, the current findings suggest that there is a need for coordinated and integrated effort of government, professionals (medical and veterinarians), community and other stake holders towards rabies control and prevention.

Key words: Animal, Human, Tigray, Rabies, Status
INTRODUCTION
Rabies is an acute viral infection affecting mainly the low and middle-income countries (Abraham et al., 2013). Dog is the principal source causing rabies through bite for more than 94% cases of rabies to human beings and other warm-blooded animals (Abebe et al., 2011; Deressa et al., 2010). Rabies potentially threatens over three billion people in Africa and Asia (WHO, 2013). People living in rural areas are at risk as vaccines and immunoglobulin are not readily available (WHO, 2013). The disease occurs in more than 150 countries with annual estimated death of more than 55,000 people from rabies each year (Andrea and Jesse, 2012) among which 31,000 and 24,000 are from Asia and Africa, respectively (Knoble et al., 2005). It is also responsible for 1.7 million global disability adjusted life years (DALYs) annually (Knoble et al., 2005; WHO, 2011). In Africa and Asia, the annual cost of livestock losses due to rabies is estimated to be US$ 12.3 Million (Knoble et al., 2005) Besides, over 15 million people receive post-exposure preventive regimen to avert the disease (WHO, 2010a) though is not accessible and affordable for the poor rural inhabitants. Hence, incidence of the disease is high in low socio-economic and illiterate group (with less awareness about its consequences and seriousness) coupled with inadequate facilities for the post-exposure vaccine (Fagbami et al., 1981; WHO, 2010b).

Rabies (“mad dog diseases” known since 1903) is endemic in Ethiopia with an estimated annual death of 2,700 (CDC, 2016), and is among the high rabies risk countries in Africa (Yousaf et al., 2012). In Ethiopia, it is expected to have one dog per five households (Deressa et al., 2010) with poor management (most freely roaming). Furthermore, in Ethiopia, individuals who are exposed to rabies virus often see traditional healers for medical intervention and most (rural residents) seek post-exposure prophylaxis (PEP) treatment after exhausting the traditional medicinal intervention (Deressa et al., 2010). As a result, rabies remains to be one of the most feared infectious diseases in the country (Fekadu, 1997; Pankhurst, 1990). Currently, the incidence of dog bite and rabies is increasing and become significant in the country due to the increasing stray dog population, and lack of dog movement control and irregular vaccination program (Deressa et al., 2010) and then is an important disease both in human and animals (Deressa et al., 2010; Yimer et al., 2002; Tschopp et al., 2016; Alem, 2017; Teklu et al., 2017).

Despite the endemic nature of rabies in Ethiopia in general and Tigray in particular, little is known about knowledge, attitude and practice level of the local community. Furthermore, there is lack of quantitative information on rabies in both human and animals to understand the epidemiological situation of rabies. Hence, the objective of the study was to assess community knowledge, attitude and practices on rabies, incidence of rabies in human and animal, and risk factors associated with its distribution in both humans and animals.

METHODS AND MATERIALS
Study Areas
The present study was conducted in eight districts from four zones of Tigray regional State from October 2016- April 2017. The total human population of the selected districts is estimated to be about 1.1 million (Table I), representing (15.16%) of the region (CSA, 2017). The four zones included were southern (Maychew and Raya-azebo districts), Eastern (Wukro, Kilteawlaelo and Hawzen Districts), southeast (Hintalowejerat and Enderta districts) and Mekelle city (all sub-cities) (Figure 1). The study area represented urban (Mekelle, Maychew and Wukro), and rural (Raya-azebo, Kilteawlaelo, Hawzen, Hintalowejerat and Enderta) settings.

Study Design and Sample Size Determination
A cross-sectional study design was employed to achieve the stated objectives. Semi-structured questionnaire was used to collect required information. The required sample size was
calculated as per the formula for known population at 95% confidence interval and 5% absolute precision levels considering 10% none response rate and two design effect factor (multistage sampling technique) (Yemane, 1967; Thrusfield, 2005). Accordingly, 880 study participants were calculated but in the actual study, 1440 participants were selected to increase precision of the study. Besides, a five-year (2012-2016) retrospective data from human hospitals and health centers, and veterinary clinics in the selected study sites was used to see trend of the disease.

**TABLE I: Geographic Locations, Size and Population of the Study Areas**

| Zones/districts | Square kilometers | Coordinates | Human population | Elevation |
|-----------------|-------------------|-------------|------------------|-----------|
| Mekelle         | 24.44 Km ^2       | 13°29’N 39°28’E | 363,200          | 2,084 m   |
| Maychew         | 9.32 Km ^2        | 12°47’N 39°33’E | 36,300           | 2,479 m   |
| Raya-azebo      | 2,132.83 Km ^2    | 12°43’N 40°2’E | 181,500          | 2,479 m   |
| Hintalowejerat  | 2,864.79 Km ^2    | 13°10’N 39°40’E | 157,300          | 2,050 m   |
| Kilteawlaelo    | 2,068.25 Km ^2    | 13°45’N 39°30’E | 133,100          | 1,930 m   |
| Wukro           | 7.07Km ^2         | 13°47’N 39°36’E | 29,200           | 1,972 m   |
| Enderta         | 3,175.31Km ^2     | 13°30’N 39°40’E | 155,400          | 2,247 m   |
| Hawzen          | 1,892.69 Km ^2    | 14°00’N 39°20’E | 145,200          | 2,105 m   |

Source: CSA, 2017

Figure 1: Map of Study region and study sites (CSA, 2016)

**Sampling Method and Data Collection**

Participants were selected using multistage random sampling technique. Primarily, four zones (Southern, Eastern, South East and Mekelle zone) from which eight districts namely Maychew, Raya-azebo, Wukro, Kilte-awlaelo, Hawzen, Hintalowejerat, Enderta and Mekelle in the regional state were purposively selected using proportion random sampling technique [18]. Secondly, peasant associations (PA) were selected using simple random sampling method within each district for the questionnaire-based survey. Thirdly, each household was selected using systematic random sampling. The target population was household heads who had lived in the area as permanent residents for more than six months. Accordingly, a total of 1440 participants (428, 219, 186, 173, 166, 47 and 38 from Mekelle, Raya azebo, Hintalo-wejerat, Enderta, Hawzen, Kilte-awlaelo, Maychew and Wukro, respectively) were communicated during the study.

**Knowledge, Attitude and Practice (KAP) Scoring**

KAP scoring was used as per the technique used by Alemu et al. (2013). For knowledge, each correct response was given a score of 1, while a wrong or unsure response was scored 0. Total knowledge scores were ranged between 0-10. Knowledge scores from 0 and 5 were considered as poor knowledge, while knowledge scores more than 5 were considered as good knowledge regarding Rabies. Attitude towards Rabies was assessed using 8 item questionnaires: attitude scores between 0 and 4 was considered as negative, whereas scores from 4 to 8 were considered as positive. Practice was also assessed using eight item questionnaire, and a score of more than 4 was considered as good practice for rabies control.

**Retrospective Study**

All public health centers (human hospitals/health centers, veterinary clinics) were visited. Five-year (2012 to 2016) data from human hospitals/health
centers, and veterinary clinics in the study districts were reviewed. Record books and reports of each office were used as source of data. Data related to human and animal exposure to rabies (dog bite cases and rabies suspected death), and dog vaccine coverage status of the five years study period were collected. Recorded data was disaggregated by sex, age, year and place. Information of individuals included in this study was kept anonymous to protect their medical confidentiality rights.

Data Management and Analysis
Collected data were entered into an excel sheet and analyzed using STATA 11.0 statistical software. Descriptive statistics were employed to summarize the data and expressed in terms of frequencies and percentages. Association between independent variables and KAP scores on rabies were calculated using Pearson’s Chi square at 95% confidence interval. For all analysis, a $P < 0.05$ was considered for significance difference.

Ethics Approval
Ethical clearance and approval was obtained from the institutional review board (IRB) of Mekelle University College of Health Sciences and Collage of Veterinary Medicine. Each participant was informed about the purpose of the study and written consent was obtained from each volunteer respondent. Participants were told to withdraw from the study at any time. Interviews were anonymous and data remained confidential throughout the study.

RESULT
Socio-Demographic Characteristics of Participants

Majority of participants (64.3%) were rural residents (Table II) and 50.1% of the total participants had owned dogs.

Community KAP about Rabies in the Study Area
The levels of KAP concerning rabies showed that 1039 (72.2%) participants had good level of knowledge, 951 (66.0%) participants had good attitude towards rabies and 898 (62.4%) participants were found with good practice level (Table III).

Knowledge of Participants
Most participants 1,371(95.2%) replied that they had heard about rabies (Table IV). However, 282(23.7%) knew rabies is caused by microorganism while 661(44.6%) participants had described starvation and thirst as causes of the disease. Rabies can be transmitted through bite and contact with saliva as known by 877 (64.8%) participants. Associated factors like residence, sex, educational status, occupation, and income status were found to be statistically associated with knowledge score of the community (Table V).

Attitude of Participants to Rabies
Majority of the participants (595; 82.8%) were in need to vaccinate their dogs, whereas 752 (54.9%) of them had strong belief on use of traditional medicine for its treatment (Table VI). Factors Residence, age, sex, educational status, occupation, and dog ownership had statistically significant difference with attitude scores of the community (Table VII).

Practice of Participants to Rabies
Among participants, 513 (71.3%) had not vaccinated their dogs against rabies (Table VIII). Furthermore, 117 (19.7%) participants had kept their pets inside their house. Males were more likely to have higher scores for preventing rabies
TABLE II: Socio-demographic information of Respondents in the study participants

| Variables | Frequency and percentage | Total |
|-----------|--------------------------|-------|
|           | Rural (%) | Urban (%) |       |
| Gender    |           |           |       |
| Male      | 623 (67.3) | 340 (66.2) | 963 (66.9) |
| Female    | 303 (32.7) | 174 (33.9) | 477 (33.1) |
| Age       |           |           |       |
| 15-35     | 410 (44.3) | 234 (45.5) | 644 (44.2) |
| 36-55     | 440 (47.5) | 258 (50.2) | 698 (48.7) |
| Above 55  | 76 (8.2)   | 22 (4.3)   | 98 (6.8) |
| Education |           |           |       |
| Illustrate| 438 (47.3) | 153 (29.8) | 519 (41.0) |
| Primary   | 259 (28.0) | 176 (34.2) | 435 (30.2) |
| Secondary | 171 (18.5) | 116 (22.6) | 287 (19.9) |
| Higher    | 58 (6.3)   | 69 (13.4)  | 127 (8.8) |
| Occupation|           |           |       |
| Civil servant | 25 (2.7)   | 55 (10.7)  | 80 (5.6) |
| Farmer    | 505 (54.5) | 56 (10.9)  | 561 (39.0) |
| Private workers | 220 (23.7) | 246 (47.9) | 466 (32.4) |
| Unemployed/housewife | 176 (19.0) | 157 (30.5) | 333 (23.1) |
| Monthly Income |          |           |       |
| Above 150 USD | 65 (7.0)   | 54 (10.5)  | 119 (8.3) |
| 50-149 USD  | 416 (44.8) | 171 (33.3) | 586 (40.7) |
| Below 50 USD | 446 (48.2) | 289 (56.2) | 735 (51.0) |
| Dog Ownership |         |           |       |
| Had Dog    | 520 (56.2) | 201 (39.1) | 721 (50.1) |
| Had No dog | 404 (43.8) | 313 (60.9) | 717 (49.9) |

TABLE III: Overall community KAP on rabies in the study area

| KAP Levels    | Number | Percent (%) |
|---------------|--------|-------------|
| Knowledge score levels |         |             |
| Good score    | 1039   | 72.2        |
| Poor score    | 401    | 27.9        |
| Attitude score level |      |             |
| Good score    | 951    | 66.0        |
| Poor score    | 489    | 34.0        |
| Practice score level |   |             |
| Good score    | 898    | 62.4        |
| Poor score    | 542    | 37.6        |

as compare to females. A higher practice scores was absorbed among civil servants 61 (78.8%) compared to other occupational categories (Table IX).

Retrospective Data
Among the total of 398 dog bite cases of domestic animals (suspected rabies cases) registered in the case book in the five years study period recorded (Table X), canine took highest number (145; 36.4%) followed by bovine (112; 28.1%). Besides, higher number of dog bite cases was recorded from Mekelle (128; 32.2%) with lower number from Maychew (21; 5.3%) (Fig 2).

Demographic Characteristics of Rabies Suspected Dogs
Higher proportion of rabies suspected cases were found in male dogs (98; 67.8%) as compare to female dogs (47; 32.4%) (Table XI). Majority of rabies suspect cases were stray dogs (123; 84.8%).

Dog Vaccination Coverage
A total of 30,325 dogs received anti-rabies vaccination during these five years with coverage in 2016 (10,903; 36.0%) (Table XII).

Human Exposure
Yearly distribution of dog bites of 21.6% and 21.8% were recorded in the year 2014 and 2015, respectively. Moreover, highest human death frequency was reported in the year 2015 (9; 35.0%) (Table XIII). The five-year retrospective data showed an overall higher prevalence dog bite on children aged between 5 and 15 years (2312; 50.1%) as compared to the other age categories (Table XIV). Similarly, higher proportion of dog bite was recorded in males (2,509; 54.3%) than in females (2,108; 45.7%).

Highest incidence of human rabies exposure cases was observed (1496; 87.0%) in Mekelle followed by Hawzen (57; 3.3%) (Fig 3). The incidence of human rabies exposure cases calculated per 100,000 populations was 392, 422, 278, 308, and 317 with incidence of 0.22, 0.24, 0.16, 0.17 and
0.18 with highest record in 2013 (422; 24.6%) and 2012 (392; 22.8%).

**TABLE IV: Knowledge of participants on Host, cause, transmission and Signs of Rabies**

| Variable | Total | $X^2$ | P-value |
|----------|-------|-------|---------|
| **Awareness about rabies** | | | |
| Yes | 1371/95.2 | 16.1994 | 0.000 |
| No | 69/4.8 | | |
| **Source of information** | | | |
| Media | 243/17.7 | 43.7611 | 0.000 |
| Family/friend/ Neighbor | 794/57.9 | | |
| Veterinarians and Health workers | 334/24.4 | | |
| **Cause of rabies** | | | |
| Microorganisms | 282/23.7 | 16.3139 | 0.000 |
| Starvation and thirst | 661/44.6 | | |
| Associated with spirit | 120/10.5 | | |
| I don’t Known | 308/16.3 | | |
| **Transmit from animal to human** | | | |
| Yes | 1227/89.5 | 16.2304 | 0.000 |
| No | 144/10.5 | | |
| **Mode of transmission** | | | |
| Bite and saliva | 877/64.8 | 22.2790 | 0.000 |
| Any contact with Infected animal | 280/20.2 | | |
| Inhalation | 167/11.6 | 16.2304 | 0.000 |
| Infected meat and milk | 47/3.41 | | |
| **Species affected by rabies** | | | |
| Dog only | 67/4.7 | 20.1182 | 0.000 |
| Dog and human | 133/9.7 | | |
| Human and others | 1171/85.4 | | |
| Animals | | | |
| **Species of animal transmit to humans** | | | |
| Dog only | 357/26.4 | 15.6616 | 0.000 |
| Dog and other animals | 1014/73.6 | | |
| **Stray dogs are important in disease transmission** | | | |
| Yes | 1041/75.9 | | |
| No | 330/24.1 | | |
| **Symptom of the diseases** | | | |
| Salivation | 512/37.4 | 52.3330 | 0.000 |
| Sudden change in behavior | 468/35.8 | | |
| Biting any object | 242/16.6 | | |
| Stop eating and drinking | 149/10.1 | | |
| **Is rabies fatal** | | | |
| Yes | 732/53.4 | 23.9150 | 0.000 |
| No | 639/46.60 | | |
**TABLE V: Risk Factors associated with community knowledge on rabies in study areas**

| Residence     | Good (%) | Poor (%) | X²      | P-value |
|----------------|----------|----------|---------|---------|
| Rural          | 473 (52.0) | 453 (48.0) | 50.2430 | 0.000   |
| urban          | 366 (71.0) | 148 (30.0) |         |         |

| Gender         | Good (%) | Poor (%) | X²      | P-value |
|----------------|----------|----------|---------|---------|
| Male           | 847 (88.0) | 116 (12.1) | 29.2602 | 0.000   |
| Female         | 377 (79.0) | 100 (21.0) |         |         |

| Age            | Good (%) | Poor (%) | X²      | P-value |
|----------------|----------|----------|---------|---------|
| 15-35          | 515 (80.0) | 129 (20.0) | 10.9304 | 0.671   |
| 36-55          | 537 (76.9) | 161 (23.1) |         |         |
| Above 55       | 76 (77.6) | 22 (22.5)  |         |         |

| Educational status | Good (%) | Poor (%) | X²      | P-value |
|--------------------|----------|----------|---------|---------|
| Illustrate         | 357 (68.0) | 170 (32.0) | 45.1176 | 0.000   |
| Primary school     | 339 (77.0) | 104 (23.0) |         |         |
| Secondary school   | 236 (80.8) | 59 (19.2)  |         |         |
| Higher education   | 117 (90.0) | 18 (11.0)  |         |         |

| Occupation        | Good (%) | Poor (%) | X²      | P-value |
|-------------------|----------|----------|---------|---------|
| Civil servant     | 63 (85.1) | 12 (15.0) | 38.719C | 0.000   |
| Farmer            | 287 (52.0) | 264 (50.0) |         |         |
| Private business  | 355 (77.9) | 96 (22.1)  |         |         |
| Unemployed/housewife | 245 (75.1) | 78 (24.9)  |         |         |

| Monthly income    | Good (%) | Poor (%) | X²      | P-value |
|-------------------|----------|----------|---------|---------|
| Above 150 USD     | 96 (80.7) | 23 (19.3) | 68.3621 | 0.000   |
| 50-149 USD        | 363 (61.9) | 223 (38.1) |         |         |
| Below 50 USD      | 412 (56.1) | 323 (44.0) |         |         |

| Dog Ownership     | Good (%) | Poor (%) | X²      | P-value |
|-------------------|----------|----------|---------|---------|
| Had Dog           | 367 (51.0) | 352 (49.0) | 21.332C | 0.349   |
| Had No dog        | 461 (63.9) | 260 (36.1) |         |         |
| Variable                                      | Value (%) | X²       | P-Value |
|-----------------------------------------------|-----------|----------|---------|
| Opinion on stray dogs                         |           |          |         |
| Should be eradicated                          | 834/57.9  | 16.5044  | 0.000   |
| Should be vaccinated                          | 176/12.2  |          |         |
| I don’t care                                  | 430/29.9  |          |         |
| Prevention of rabies through                  |           |          |         |
| Vaccination                                   | 845/61.9  | 78.7853  | 0.000   |
| Restrict movement                             | 174/14.5  |          |         |
| Killing stray dogs                            | 159/11.4  |          |         |
| Not aware                                     | 193/11.1  |          |         |
| Willingness to vaccinate                      |           |          |         |
| Positive                                      | 595/82.8  | 1.2126   | 0.545   |
| Not committed                                 | 124/17.2  |          |         |
| Willingness to pay vaccine                    |           |          |         |
| Positive                                      | 560/77.9  |          |         |
| Not committed                                 | 159/22.1  |          |         |
| Want to get training                          |           |          |         |
| Yes                                           | 1338/92.9 | 4.2290   | 0.040   |
| No                                            | 102/7.1   |          |         |
| Dog registration can help in control of rabies|           |          |         |
| Yes                                           | 267/20.1  | 50.7568  | 0.000   |
| No                                            | 687/48.5  |          |         |
| I don’t know                                  | 417/31.8  |          |         |
| Preferable treatment after human bitten       |           |          |         |
| Medical seek                                  | 573/41.7  | 122.5141 | 0.000   |
| Traditional medicine                          | 752/54.9  |          |         |
| Holy water                                    | 46/3.3    |          |         |
| Opinion on rabid animal                       |           |          |         |
| Kill                                          | 1089/81.0 | 493025   | 0.000   |
| Tie                                           | 187/12.3  |          |         |
| Rx/tradition/holy spirit                      | 95/6.6    |          |         |
Figure 2: Place basis distribution of rabies suspected cases

Figure 3: Trend of human rabies incidence in place and year (2012 - 2016)
DISCUSSION

Higher proportion of the participants had indicated that they had heard about rabies and its public health importance. Similar findings had reported in various part of the country such as Delo district of Jimma zone (Abdela et al., 2017), Debark district of North Gondar (Yalemebrat et al., 2016), Gondar (Digaf et al., 2015), and in Addis Ababa (Ali et al., 2013). However, the variation among all data might be due to living status of the community (Ali et al., 2013), difference on health education programs, low media accessibility to remote rural area and education coverage. Low access to mass media observed in the current finding and supported by other findings in Bahirdar (Guadu et al., 2014) and in Debark (Yalemebrat et al., 2016) which could be due to absence of community-based radio station and television programs. Awareness of the community on dynamics of the disease and its treatment was traditional and hence, could hide and aggravate the status of the disease in the area and to the global community. More than 44% of the participant associated the cause of the disease to starvation and thirst. This was supported by the findings of in Dessie (Yalemebrat et al., 2016), Bahirdar (Guadu et al., 2014), Gondar (Jemberu et al., 2013) and Debark (Yalemebrat et al., 2016) and Debark (Yalemebrat et al., 2016).
TABLE VIII: Communities practice to rabies in the Study Area

| Variable                      | Total       | X²          | P-Value |
|-------------------------------|-------------|-------------|---------|
| **Do you have a dog**         |             |             |         |
| Yes                           | 719 (49.9)  | 38.4365     | 0.000   |
| No                            | 721 (50.1)  |             |         |
| **Purpose of kept**           |             |             |         |
| Guard at home                 | 582 (80.9)  |             |         |
| Home pet                      | 57 (7.9)    |             |         |
| Hunting                       | 80 (11.1)   |             |         |
| **Dog management practice**   |             |             |         |
| Kept in door                  | 117 (19.7)  | 67.1506     | 0.000   |
| Roaming day/night             | 371 (50.6)  |             |         |
| Let free                      | 231 (29.7)  |             |         |
| **Do you vaccinate your dog** |             |             |         |
| Yes                           | 206 (28.7)  | 68.3416     | 0.000   |
| No                            | 513 (71.3)  |             |         |
| **Do you have a vaccine certificate** | | | |
| Yes                           | 128 (62.1)  | 0.6140      | 0.736   |
| No                            | 76 (72.9)   |             |         |
| **Ever participate in control programme** | | | |
| Yes                           | 64 (4.7)    | 21.6193     | 0.000   |
| No                            | 1307 (95.3) |             |         |
| **Immediate action after bite** | | | |
| Wash with water and soap      | 355 (25.9)  | 288.0705    | 0.000   |
| Tie with close                | 216 (15.7)  |             |         |
| Herbal extracts               | 386 (28.1)  |             |         |
| Do nothing                    | 414 (30.1)  |             |         |
| **Availability of vaccine**   |             |             |         |
| Always                        | 9 (1.2)     | 52.6800     | 0.000   |
| Sometimes                     | 498 (69.3)  |             |         |
| No                            | 212 (29.5)  |             |         |
**TABLE IX: Risk Factors associated with practice on rabies by the Community**

| Variables         | Good (%) | Poor (%) | X²   | P Values |
|-------------------|----------|----------|------|----------|
| Residence         |          |          |      |          |
| Rural             | 500 (54.0) | 426 (46.0) | 112.49 | 0.000    |
| Urban             | 185 (36.0) | 329 (64.0) |      |          |
| Gender            |          |          |      |          |
| Male              | 674 (70.0) | 289 (30.0) | 27.93 | 0.037    |
| Female            | 304 (63.8) | 173 (36.2) |      |          |
| Age               |          |          |      |          |
| 15-35             | 412 (64.0) | 232 (36.0) | 6.34  | 0.103    |
| 36-55             | 495 (70.9) | 203 (29.1) |      |          |
| Above 55          | 62 (63.3)  | 36 (36.7)  |      |          |
| Educational status|          |          |      |          |
| Illiterate        | 248 (47.0) | 279 (53.0) | 53.94 | 0.000    |
| Primary school    | 287 (65.1) | 156 (35.0) |      |          |
| Secondary school  | 210 (71.8) | 85 (28.2)  |      |          |
| Higher education  | 105 (79.5) | 31 (21.0)  |      |          |
| Occupation        |          |          |      |          |
| Civil servant     | 61 (78.8)  | 14 (21.3)  | 94.80 | 0.000    |
| Farmer            | 269 (50.1) | 267 (49.9) |      |          |
| Private business  | 342 (75.1) | 19 (25.0)  |      |          |
| Unemployed/housewife | 231 (70.9) | 92 (29.1)  |      |          |
| Monthly income    |          |          |      |          |
| Above 150 USD     | 71 (59.7)  | 48 (40.3)  | 2.30  | 0.401    |
| 50-149 USD        | 353 (60.2) | 233 (39.8) |      |          |
| Below 50 USD      | 401 (54.1) | 334 (45.9) |      |          |
| Dog Ownership     |          |          |      |          |
| Had Dog           | 354 (49.2) | 365 (50.8) | 28.48 | 0.007    |
| Had No dog        | 449 (62.3) | 272 (37.7) |      |          |

**TABLE X: Distributions of dog bite cases in different animal species (2012 - 2016)**

| Year | Frequency (%) | Canine | Bovine | Ovine | Equine | Swine |
|------|---------------|--------|--------|-------|--------|-------|
| 2012 | 86 (21.6)     | 32 (37.2) | 25 (29.1) | 21 (24.4) | 6 (7.0) | 1 (1.1) |
| 2013 | 70 (17.6)     | 21 (30.0) | 23 (32.8) | 13 (18.6) | 11 (15.7) | 2 (2.3) |
| 2014 | 59 (14.8)     | 19 (32.2) | 11 (18.6) | 23 (39.0) | 5 (8.3)  | -     |
| 2015 | 106 (26.6)    | 41 (38.7) | 32 (31.1) | 20 (18.9) | 10 (9.4) | 1 (0.9) |
| 2016 | 77 (19.3)     | 27 (35.1) | 21 (27.3) | 24 (31.1) | 4 (5.2)  | -     |
TABLE XI: Demographic characteristics of suspected Rabid dogs during 2012 - 2016

| Characteristic       | No. Suspected Case | Percent (%) |
|----------------------|--------------------|-------------|
| **Sex**              |                    |             |
| Male                 | 98                 | 67.8        |
| Female               | 47                 | 32.4        |
| **Age**              |                    |             |
| ≤ 6 months           | 48                 | 33.1        |
| 6- 18 months         | 73                 | 50.3        |
| Above 18 months      | 24                 | 16.6        |
| **Dog ownership**    |                    |             |
| Owned and roaming    | 22                 | 15.2        |
| Stray/ownerless      | 123                | 84.8        |

TABLE XII: Vaccination coverage of dogs in different districts during 2012 – 2016

| Zones/Wereda         | Number of vaccinated dogs in years |
|----------------------|-----------------------------------|
|                      | 2012    | 2013   | 2014    | 2015    | 2016    | Total   |
| Mekelle              | 1792    | 885    | 300     | 3780    | 4836    | 12093   |
| Maychew              | 387     | 450    | 490     | 270     | 90      | 1687    |
| Raya-azebo           | 144     | 101    | 147     | 403     | 320     | 1115    |
| H/wejerat            | 99      | 459    | 151     | 502     | 1500    | 2711    |
| K/awlaelo            | 306     | 894    | 1450    | 752     | 1251    | 4653    |
| Wukro                | 306     | 894    | 1450    | 640     | 1251    | 4541    |
| Enderta              | 18      | 257    | 190     | 205     | 550     | 1220    |
| Hawzen               | 141     | 506    | 449     | 604     | 1105    | 2805    |
| **Total**            | 3193    | 4446   | 4627    | 7156    | 10903   | 30325   |

TABLE XIII: Five years Occurrence of suspected cases of human rabies and death in place and year (2012 to 2016 GC)

| Zones/ Weredas       | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | Total Case (%) |
|----------------------|------|------|------|------|------|------|----------------|
| **2012**             |      |      |      |      |      |      |                |
| **South zone**       |      |      |      |      |      |      |                |
| Maichew              | 12 (1.5) | 1  | 14 (1.6) | 0 | 15 (1.5) | 0 | 18 (1.8) | 1 | 16 (1.7) | 0 | 75 (1.6) |
| Raya-azebo           | 14 (1.8) | 0  | 15 (1.7) | 1 | 12 (1.2) | 0 | 16 (1.6) | 2 | 15 (1.6) | 1 | 74 (1.6) |
| **South east zone**  |      |      |      |      |      |      |                |
| Enderta              | 12 (1.5) | 0  | 6 (0.7)  | 1 | 14 (1.4) | 0 | 25 (2.5) | 0 | 16 (1.7) | 1 | 73 (1.6) |
| Hintalo-wajerat      | 19 (2.4) | 1  | 15 (1.7) | 0 | 25 (2.5) | 2 | 17 (1.7) | 1 | 17 (1.8) | 0 | 94 (2.0) |
| **Eastern zone**     |      |      |      |      |      |      |                |
| Kilde-awalo          | 34 (4.3) | 2  | 30 (3.5) | 0 | 43 (4.3) | 1 | 28 (2.8) | 0 | 40 (4.3) | 0 | 176 (3.8) |
| Wukro                | 13 (1.6) | 0  | 17 (2.0) | 0 | 14 (1.4) | 0 | 18 (1.8) | 1 | 11 (1.2) | 0 | 73 (1.6) |
| Hawzen               | 25 (3.1) | 1  | 16 (1.9) | 0 | 25 (2.5) | 0 | 15 (1.5) | 2 | 26 (2.8) | 1 | 109 (2.4) |
| **Mekelle**          | 670   | 1   | 750   | 0  | 850   | 1  | 870   | 2  | 801   | 2  | 3943 |
| Total (%)            | 799   | 6   | 863   | 2  | 998   | 4  | 1007  | 9  | 942   | 5  | 4617 |

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et al., 2016). The current finding had indicated that only 53.4% participants recognized rabies as a fatal disease as found in other part of the country such as Nekemte (Tolessa and Mengistu, 2017) and Addis Ababa (Ali et al., 2013). This could have impact on mortality rate, distribution of the disease and challenge for implementation of control strategies. This is also in line with the low access too modern treatment but usual habitat of the community towards traditional medication. Majority of the participants (82.75%) had indicated their willingness to vaccinate their pets. However, most participants showed going to traditional healer after exposing to suspected dog bite. This finding is supported by Yalemebrat et al. (2016) in Debark although was found higher than report by Jemberu et al (2013) in Dabat and Gondar. On the other hand, more than 98% participants from Addis Ababa agreed to consult health professional in case of animal bite (Ali et al., 2013). The variation on community preference to modern medicine could be due various factors including lack of awareness, inaccessibility to modern treatment (post exposure anti-rabies vaccine), an affordable vaccine price, long duration of treatment and unavailability of qualified professionals.

A few of the dog owners had indicated they were concerned about restraining of their dogs. A significant number of households in Sub-Saharan Africa countries are less likely to confine their dogs both in urban and rural areas (Butler and Bingham, 2000). However, only 28.71% of the pet owners had vaccinated their animals to control rabies which is much below the figure 70% as recommended by WHO (2005). The reason could be due to minimal awareness about the importance of vaccine, low access to vaccine, low and irregular vaccination service, absence or poorly enforced legislation/guidelines about responsibility of dog ownership. Major

### Table XIV: Five years Incidence of dog bite cases in humans by age and sex (2012 to 2016 GC)

| Zone/Wereda’s | <5 (%) | 5 to 15 | >15 | Male | Female |
|---------------|--------|---------|-----|------|--------|
| **Eastern Zone** |        |         |     |      |        |
| Kilit awilealo | 37 (5.0) | 52 (2.2) | 87 (5.6) | 99 (3.9) | 77 (3.7) |
| K/Wukro | 11 (1.5) | 28 (1.2) | 34 (2.2) | 34 (1.4) | 39 (1.9) |
| Hawizen | 25 (3.4) | 34 (1.5) | 50 (3.2) | 66 (2.6) | 43 (2.0) |
| **South Zone** |        |         |     |      |        |
| K/mychew | 10 (1.3) | 24 (1.0) | 41 (2.6) | 34 (1.4) | 41 (1.9) |
| R/azebo | 9 (1.2) | 19 (0.8) | 46 (3.0) | 40 (1.6) | 34 (1.6) |
| **South East Zone** |        |         |     |      |        |
| Hinitalo wajirat | 13 (1.7) | 24 (1.0) | 57 (3.7) | 51 (2.0) | 43 (2.0) |
| Enderta | 7 (1.0) | 31 (1.3) | 35 (2.2) | 31 (1.2) | 42 (2.0) |
| **Mekelle Zone** |        |         |     |      |        |
| Mekelle | 634 (85.0) | 2100 (90.8) | 1209 (77.5) | 2154 (85.9) | 1789 (84.9) |
| **Total** | 746 (16.2) | 2312 (50.1) | 1559 (33.8) | 2509 (54.3) | 2108 (45.7) |
constraints for effective vaccination in dogs are inadequate availability of vaccines, poor public awareness, irregular vaccination and the relative high cost of vaccines (WHO, 2014; Perry et al., 1995). The current retrospective data result indicated highest proportion (84.8%) of confirmed rabies cases in stray dogs as compared to owned with no restraint. This could indicate the risk of exposure of stray dogs and/or free roaming dogs to wild reservoirs.

The highest proportion of children (5-15 years old) were affected and may be due to frequent contact with dogs resulting in the high rate of exposure to dog bites. It may also be attributed to their limited awareness about the disease.

CONCLUSION
Attitude and practice of participants towards rabies management, control and prevention were not encouraging although majority had knowledge about its public health consequence. Educational status, sex, and rural/urban residence of participants found to have relationship with good KAP score. Data collected from health centers and veterinary clinics had indicated number of rabies exposure in both humans and animals. A stress on controlling of stray dog population, public education, dog registration and traceability need to be established to control rabies in future.

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