TUNGIASIS OUTBREAK INVESTIGATION IN MASAITI DISTRICT, ZAMBIA

OUTBREAK REPORT

N L Mulambya [1, 2, 3] **P Sakubita**[1, 2, 3] **R Hamoonga**[2] **B Mulubwa**[2, 3] **O Namafente**[4] **M Mutengo**[3, 5] **E Yard**[6]

1. Field Epidemiology Training Program, Lusaka, Zambia.
2. Zambia National Public Health Institute,
3. Ministry of Health
4. Tropical Disease Research Centre, Department of Entomology and Vector Control, Ndola Zambia,
5. University Teaching Hospital, Department of Pathology and Microbiology, Parasitology Unit,
6. The US Centres for Disease Control and Prevention

Corresponding author: Nelia Langa, (nmulambya2000@gmail.com)

Citation style for this article: Mulambya N L, Sakubita P, Hamoonga R, Mulubwa B, Namafente O, Mutengo M, Yard E. Tungiasis Outbreak Investigation In Masaiti District, Zambia. Health Press Zambia Bull. 2018 2(9); pp 8-16.

Tungiasis is a neglected tropical disease caused by infestation by the female sand flea Tunga penetrans. Primary reservoirs include livestock such as pigs, goats and cattle. Infection occurs when skin comes into with fleas in soil of floor. The flea burrows in the epidermis of the skin causing local itching and irritation. An outbreak of tungiasis was reported in Njelemani area, Masaiti district of Copperbelt province in October 2017. We investigated to determine the magnitude and geographic spread of the outbreak, and conducted epidemiologic and clinical assessment of cases in the affected communities.

Key words: Tunga penetrans, tungiasis, jiggers, Zambia

METHODS:

We defined a case of tungiasis as any person from Njelemani area with T.penetrans associated lesions (i.e. white patch or black dot with pain and or itching) on any part of the body from 1st August to 13th October 2017. We reviewed records and conducted active case search. We calculated attack rates by using population estimates from central statistical office 2010 census. We interviewed a convenient sample of case-patients using a structured questionnaire and collected data on demographics, tungiasis symptoms, location of lesions and hygiene practices. In addition, eggs and fleas were collected from patients and the environment for microscopic examination. Descriptive analyses were performed using Epi info 7.

RESULTS:

We identified 192 tungiasis case-patients during the 1st August to 13th October of which 120 (63%) were male, constituting an attack rate of 16%. Of the 66 cases interviewed, majority (40%) were children aged 0-9 years of which 66% were males. Almost all (91%) lesions were located on the feet. Predominant symptoms were itching 66 (100%) and pain 49 (75%). Although 85% of cases reported having footwear, only 16% wore them regularly. More than half (56%) of case patients had dirty feet and half of the houses in the area were temporary structures with bare earthen floors. Laboratory investigations revealed the presence of T.penetrans eggs from the lesions of eight cases-patients.

CONCLUSION:

An outbreak of tungiasis occurred in Njelemani area of Masaiti district. Interventions aimed at raising awareness, promoting regular use of footwear, hygiene and maintenance of housing floors remains essential in controlling and preventing tungiasis. Furthermore, we recommend strengthening collaboration between the Ministries of Health and Livestock and Veterinary services since tungiasis affects both humans and animals.

INTRODUCTION

Tungiasis is a neglected tropical disease caused by infestation by the female sand flea Tunga penetrans also commonly known as jigger or chigoe [1]. The flea burrows in the epidermis of the skin. While in the epidermis, the flea increases in body volume causing local itching and irritation. Tungiasis is a zoonosis affecting both humans and animals. Reservoirs for human infection are predominantly pigs and bovines; but may include dogs, cats and rats in resource-poor urban communities [1] [15]. Studies conducted in Brazil have shown high risk of human tungiasis in communities were animal tungiasis is high. [3]. T. penetrans fleas penetrate the skin when it comes into contact with soil or floors which have developed sand fleas [2]. Tungiasis is common in villages and shanty neighborhoods of cities with low economic conditions [3]. A study conducted

Most (99%) of the lesions occur on the feet although any part of the body can be affected [1]. Tungiasis is a debilitating disease that can lead to restricted mobility especially if one has multiple lesions. Complications of chronic tungiasis may include bacteria superinfection of the lesions resulting in abscesses and lymphangitis [4]. Deformity and mutilation of the feet due to reoccurring infections may lead to impaired mobility and contribute to stigma and absenteeism

among school going children [5, 6]. Studies conducted in Africa, Asia and South America have shown that tungiasis is associated with poor housing and low socio-economic status. In Zambia the overall prevalence of human tungiasis is unknown serve for the study conducted in Chipata and Vubwi eastern province in 2015 showed an overall prevalence of 13.5%.

The Ministry of Health through the Copperbelt Provincial health office was alerted to an outbreak of tungiasis in Njelemani village in Masaiti District on 21st September 2017. Masaiti is one of the three rural districts on the Copperbelt province. It is located 343 kilometers north of Lusaka. The district has an estimated total population of 118,548 [7]. Njelemani has a population of 6117 [7] and ten (10) neighborhood health committees. The health facility has reported sporadic cases of tungiasis since 2003. However, in August 2017 there was a spike in the number of cases and affected households. To determine the magnitude and the geographic spread of the outbreak, we conducted a descriptive epidemiologic and clinical assessment of the cases in the affected communities.

METHODS

We defined a case of tungiasis as any person from Njelemani area with T. penetrans associated lesions (i.e. white patch, black dot with pain and itching) on any part of the body from 1st August to 13th October 2017. We reviewed facility records which showed the number of tungiasis cases per year and the villages which were affected. We also conducted active case search for tungiasis cases in affected villages. We interviewed a convenient sample of case-patients using a structured questionnaire and collected geographic coordinates of the area. We collected data on demographics, clinical symptoms, location of lesions, hygiene practices, treatment, housing characteristics, number and type of animals, access to veterinary services and observed animals for lesions. We calculated the attack rate based on the total population in affected villages Clinical assessment and staging was conducted using the Fortaleza classification criteria. The criteria was described by Eisele et al (2003) consisting of five (5) stages. Stage 1 characterized by penetration of skin by flea, stage 2 complete penetration and burrowing of most of the fleas body leaving only hind quarters, stage 3 the flea achieves maximum hypertrophy, the skin layer thins out resulting in the appearance of a white halo around a black dot. Egg release is common at this stage. Stage 4, the flea dies, the lesion shrinks in size, turns brown and appears wrinkled. Stage 4b is characterized by flea elimination through skin repair. Stage 5, the dead flea has been expelled leaving characteristic circular skin residues of infection and brown black appearance. In addition, eggs and fleas were collected from cases and the environment for laboratory confirmation of T.penetrans. GPS coordinates were also collected to map out the spatial distribution of cases. We also observed the feet of respondents for cleanness using agreed upon rating. We used Epi info 7 to obtain descriptive statistics.

ETHICAL CONSIDERATION

Since the study was conducted as part of an outbreak response, ethical clearance waiver was obtained from the Tropical Disease Research Centre (TDRC) ethics committee. Consent was obtained from participants aged 18 years and older. We obtained assent from children younger than 18years and consent from their parents and guardians.

RESULTS

As seen in Figure 1, there has been a cumulative 944 of tungiasis cases in Njelemani since 2003. After a peak in 2003, a reduction in the prevalence of tungiasis was noted. However, in 2017, an increase in the number of cases was observed. Following interventions, the number of cases reduced drastically as noted in (fig. 2).

During the outbreak period, a total of 192 cases of tungiasis were identified of which 63% (120) were males and 38% (72) were females, constituting an attack rate of 16%. A total of 66 cases were interviewed, of these, majority (41%) were children aged 0-9 years. In this age group, 33% were females and 67% were males. More than 50% of the cases lived in temporary houses while only 10% lived in permanent houses (Table 1). Almost all (91%) lesions were located on the feet and 7% on the fingers. Predominant symptoms were itching 66 (100%), and pain 49(75%). The number of lesions per person ranged from 1 to 20 with a median of 3. About 7% of the cases had severe tungiasis with lesions ranging from 11-20. Fortaleza classification revealed multiple staging with 53% of cases in stage II, 43% stage III (Eisele M et al. 2003) (Table 2). In relation to foot wear, 85% (56) of the respondents reported having footwear while 15% (10) had no footwear. Although 85% of cases had foot wear, more than half 66% wore them occasionally and only 5% reported wearing them all the time. Hygiene was assessed by observing the feet of the respondents for cleanness, and more than half (57%) of the cases had feet that were classified as dirty. The most common type of animals kept in the community were goats (43%) and pigs (39%). Some of the pigs examined had lesions associated with T. penetrans infestation.

Table 1: Socio-demographic characteristics of respondents of Njelemani area Masaiti District Zambia August – October,2017

Characteristic	Frequencies (Percent)
Age	(n=66) (%)
0 – 9	27 (41)
10 - 19	19 (29)
20 - 29	8 (12)
30 - 39	5(8)
>40	7(11)
Median age	13.5 (6,23)
Sex	
Male	42 (64)
Female	24 (36)
Education level	
None	32(48)
Primary	29 (44)
Secondary	5 (8)
Source of income (n=63)	
Farming	51 (73)
None	11 (16)
Casual Work	7 (8)
None	2 (3)
Housing Type (n=66)	
Temporary	33 (50)
Semi-permanent	23 (35)
Permanent	10 (15)
Type of wall	
Mud plastered	56(85)
Not plastered	7(10)
Cement plastered	3(7)
Type of floor	
Bare ground	51(75)
Concrete	13(19)
Other	4(6
Source of water	
Communal borehole	40 (59)
Shallow well	19 (29)
Shallow well	8 (12)

Table 2: Clinical assessment of tungiasis cases in Njelemani area Masaiti District, Zambia August – October 2017

Location of lesions	Frequency (%)
Feet	60 (91)
Finger and feet	5 (7)
Forearm	1 (2)
Number of lesions	
1-5	50 (76)
6-10	11 (17)
11-20	5 (7)
Fortaleza classification	
Stage 1	28 (24)
Stage II	37 (32)
Stage III	24 (21)
Stage IV	14 (12)
Stage V	12 (10)

Table 3 Factors associated with tungiasis in Njelemani area of Masaiti district, Zambia August – October, 2017

Variable	Frequency (%) =66
Foot wear	
Do not wear	10 (15)
Wear footwear	56 (85)
Type of foot wear	
Open	25 (45)
Closed	31 (55)
Use of foot wear	
Sometimes	37 (66)
Most of the times	16 (29)
All of the times	3 (5)
Heard of tungiasis	
No	50 (75)
Yes	17 (25)
Hygiene	
Dirty feet	38 (57)
Clean feet	29 (43)
Livestock	
Goats	33 (43)
Pigs	26 (39)
None	21 (31)
Cattle	1 (2)*

**Percentages >100 due to multiple responses*

LABORATORY FINDINGS

Although the diagnosis of tungiasis is clinical, samples were collected from 8 patients who had various stages of lesions and were examined microscopically for the presence of T. penetrans eggs. In addition, the characteristic adult T. penetrans flea was identified on microscopic examination.

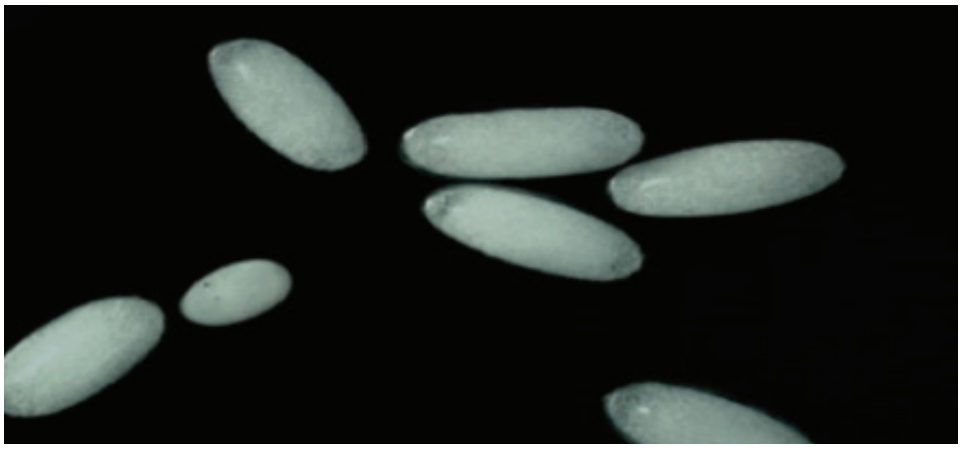

Fig 4: Sand flea eggs, x40 magnification

Fig 5: Adult T. penetrans collected from the environment of one of the affected communities in Njelemani area of Masaiti

DISCUSSION

In our study, majority of case-patients were males. Similar findings were observed in Haiti, where more males were affected than females [8]. Males are more likely to be involved in activities that are more likely to expose them to sand fleas such as playing football barefoot. The findings of this study are consistent with the findings of a study conducted by Kampamba et al 2015 which showed high prevalence among persons aged under 15years. Most of the respondents were children aged 0-9years, a finding consistent with the study carried out in southern Ethiopia, were most cases were children ages 5-14 years [8-10]. Similar findings were observed in Tanzania and Nigeria, were children were more affected than adults [11] [12]. The finding could be due to the fact that children are more likely to be exposed to the sand fleas as they play barefoot. It is also possible that affected adults may remove the fleas on their own. The finding may also be related to selection bias were children are likely to complain about T.penetrans symptoms while adults may shy away.

With regard to education, only a small percentage of respondents had attained secondary level education, a finding which is in tandem with that of a Ugandan study which showed that secondary level education was protective against tungiasis. People with secondary or higher education are more informed and practice high levels of hygiene as compared to those with primary or no education [13]. This finding may also be attributed to the general low number of people with secondary education in the community.

A study conducted in Uganda showed an association among poor housing, cracked walls, earthen and dusty floors and tungiasis [13]. Similarly our study showed poor housing in the affected area with half of the structures being temporally (Table 1). Furthermore, two thirds of the houses had bare ground or earthen floors a finding which is consistent with studies conducted in Nigeria and Uganda [14], [13]. The high number of houses with earthen dusty floors could be attributed to lack of knowledge on T.penetrans prevention among the community members. Dusty earthen floors are very conducive for the fleas.

Although our study findings show that two thirds of the case-patients lacked knowledge on the cause of tungiasis, they were aware of the signs and symptoms, contrary to the findings of Mutebi and others in Uganda[15]. Almost all affected persons preferred self-treatment by extracting embedded fleas using non-sterile sharp instruments such as pins, needles and thorns instead of visiting the health facility similar to the findings in other tungiasis studies [2], [12], [10].

Despite more than three quarters of the case-patients in our study reporting having shoes, only less than a quarter wore them regularly. Regular usage of shoes has been shown to have a protective effect against tungiasis. In a study in Madagascar, the protective effect of shoes from sand fleas was related to the regularity of footwear use [16]. However, it appears that only closed shoes offer some protection.[17] A report from an outbreak investigation in Ethiopia showed that most tourists who had tungiasis wore open shoes [18]. A similar

observation was noted in our study were almost half of the case-patients had open shoes. In our study it was noted that close to half of the case-patients who reported having footwear had open shoes. This finding could be due to lack of knowledge on the type of shoes and exposure to fleas. On removal of T.penetrans fleas, nearly all respondents preferred using thorns, razors, pins, chemical pesticides and needles, a finding consistent with studies conducted in Tanzania, Uganda, Kenya and Nigeria [11, 13-15]. However, these are unsafe practices that could lead to transmission of blood-borne pathogens such as hepatitis B and C virus, possibly also HIV [1].

Personal hygiene practices such as having dirty feet, and putting on dirty clothes are associated with tungiasis. Dirty feet and clothes provide a conducive environment for T. penetrans to survive and hide [11]. This is consistent with our study findings where 55% of the respondents had dirty feet. Several studies have highlighted personal hygiene as an important factor in the control and prevention of T. penetrans [13], [11]. Poor hygiene among our case-patients could also be attributed to distance to water sources in the area. Some villages had unsafe water sources which they shared with animals. Lack of knowledge on hygiene practices therefore remains key in the prevention of tungiasis.

In the present study, most of the pigs in Njelemani area had lesions a finding consistent with other studies which have shown pigs to be the most common animal reservoir of sand fleas [12]. It should be noted that goats were the most common animals in the community but they had no lesions. This could be due to natural resistance to diseases and infection. However, a study conducted in Uganda showed that goats can also be infected by T.penetrans [19]. Limited access to veterinary services in the area could have contributed to the sudden increase in the number of tungiasis cases.

CONCLUSION

Tungiasis is a common health problem in Njelemani area of Masaiti district. The control of tungiasis requires a one health approach combining efforts and strengthening collaboration between the Ministries of Health and Livestock and Veterinary services since it affects both humans and animals. Interventions aimed at raising awareness and promoting regular use of footwear, hygiene practices and regular maintenance of housing floors remains essential in controlling and preventing tungiasis.

LIMITATIONS

The sample size for this study was small and hence cannot be generalized to a larger population. Furthermore, there was no comparison group which prohibited looking at risk factors. We therefore recommend that other more analytical studies be conducted in order to gain more understanding of risk factors, animal reservoirs and disease related behavior in the study community.

Figure 1

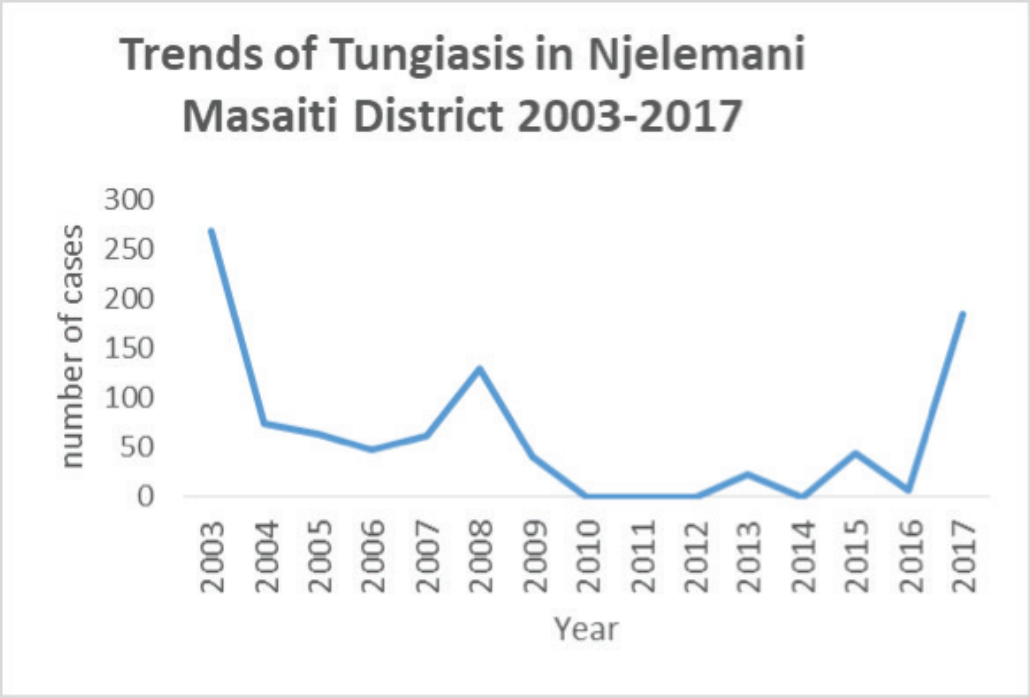

Fig 2 shows the epi-curve of the tungiasis outbreak in Njelemani area of Masaiti district

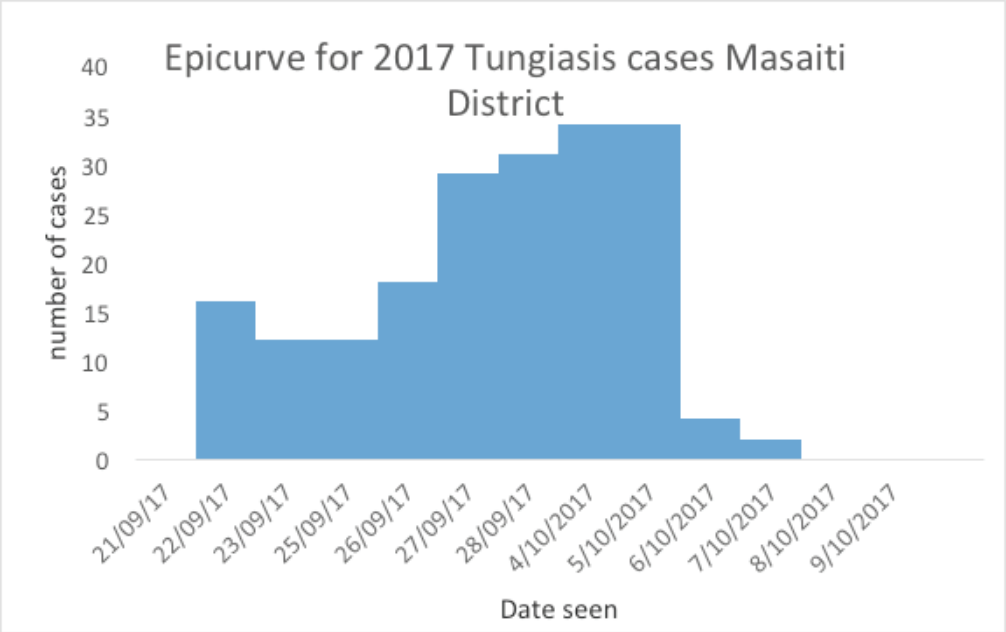

Fig 3: Map of Copperbelt province showing Masaiti district

Fig 4: Map of Njelemani health centre and surrounding villages showing cases of tungiasis (n=66

COMPETING INTERESTS:

The authors declare no competing interests

Author's contributions

Nelia Langa, Patrick Sakubita, Osbert Namafente, Raymond Hamoonga, Mable M. Mutengo Ellen Yard contributed to writing and review the draft and final article

Mable Mutengo and Osbert Namafente participated in data and specimen collection for microscopy

ACKNOWLEDGEMENTS

This investigation was funded by the Zambia Ministry of Health and the Zambia National Public Health Institute, and in part by the U.S President's Emergency Plan for AIDS Relief (PEPFAR).

We appreciate the onsite mentorship of Dr. Ellen Yard; Zambia Field Epidemiology Training Program resident advisor.

The Provincial Health Director Copperbelt province Dr. C. Mwale, the Public Health Specialist Dr. Sakulanda and provincial surveillance officer Albert Mweemba.

The District Health Director; Masaiti District Dr. Mwaba, and the district Environmental Health team.

Ms Mwaka Kafuko, Nurse-in-charge at Njelemani Zonal Health and the team for making the investigation and control a success.

LIST OF REFERENCES

1. Feldmeier, H., E. Sentongo, and I. Krantz, Tungiasis (sand flea disease): a parasitic disease with particular challenges for public health. Eur J Clin Microbiol Infect Dis, 2013. 32(1): p. 19-26.

2. Karunamoorthi, K., Tungiasis: a neglected epidermal parasitic skin disease of marginalized populations--a call for global science and policy. Parasitol Res, 2013. 112(10): p. 3635-43.

3. De Avelar, D.M., E.J. Facury Filho, and P.M. Linardi, A new species of Tunga (Siphonaptera: Tungidae) parasitizing cattle from Brazil. J Med Entomol, 2013. 50(4): p. 679-84.

4. Bouree, P., L. Osse, and F. Rabenandrasana, [Tungiasis, an uncommon ectoparisitic disease]. Rev Prat, 2009. 59(2): p. 163-

5. Wiese, S., et al., Prevalence, intensity and risk factors of tungiasis in Kilifi County, Kenya: I. Results from a community-based study. PLoS Negl Trop Dis, 2017. 11(10): p. e0005925.

6. Ferreira, L.A., et al., Tunga penetrans as a traveler's disease. Travel Med Infect Dis, 2009. 7(6): p. 381-2.

7. CSO, C.S.O., 2010 Census of population and housing national analytical report. 2012, CSO: Lusaka. p. DF-1.4 .

8. Louis, S.J., et al., Tungiasis in Haiti: a case series of 383 patients. Int J Dermatol, 2014. 53(8): p. 999-1004.

9. Walker, S.L., et al., The prevalence and association with health-related quality of life of tungiasis and scabies in schoolchildren in southern Ethiopia. PLoS Negl Trop Dis, 2017. 11(8): p. e0005808.

10. Kimani, B., J. Nyagero, and L. Ikamari, Knowledge, attitude and practices on jigger infestation among household members aged 18 to 60 years: case study of a rural location in Kenya. Pan Afr Med J, 2012. 13 Suppl 1: p. 7.

11. Dassoni, F., et al., Tungiasis in Northern Tanzania: a clinical report from Qameyu village, Babati District, Manyara Region. J Infect Dev Ctries, 2014. 8(11): p. 1456-60.

12. Ugbomoiko, U.S., et al., Risk factors for tungiasis in Nigeria: identification of targets for effective intervention. PLoS Negl Trop Dis, 2007. 1(3): p. e87.

13. Wafula, S.T., et al., Prevalence and risk factors associated with tungiasis in Mayuge district, Eastern Uganda. Pan Afr Med J, 2016. 24: p. 77.

14. Ugbomoiko, U.S., et al., Prevalence and clinical aspects of tungiasis in south-west Nigerian schoolchildren. Tropical Doctor, 2017. 47(1): p. 34-38.

15. Mutebi, F., et al., Animal and human tungiasis-related knowledge and treatment practices among animal keeping households in Bugiri District, South-Eastern Uganda. Acta Tropica, 2018. 177: p. 81-88.

16. Thielecke, M. and H. Feldmeier, The fate of the embedded virgin sand flea Tunga penetrans: hypothesis, self-experimentation and photographic sequence. Travel Med Infect Dis, 2013. 11(6): p. 440-3.

17. Mwangi, J.N., H.S. Ozwara, and M.M. Gicheru, Epidemiology of tunga penetrans infestation in selected areas in Kiharu constituency, Murang'a County, Kenya. Trop Dis Travel Med Vaccines, 2015. 1: p. 13.

18. Grupper, M. and I. Potasman, Outbreak of tungiasis following a trip to Ethiopia. Travel Med Infect Dis, 2012. 10(5-6): p. 220-3.

19. Mutebi, F., et al., Two Severe Cases of Tungiasis in Goat Kids in Uganda. J Insect Sci, 2016. 16.

MORTALITY AND CAUSE OF DEATH PROFILE FOR DEATHS FROM THE CIVIL REGISTRATION SYSTEM: 2017 FACTS AND FIGURES

RESEARCH ARTICLE

M Nyahoda[1*], J Banda[2], C Mwango[2], B Mukombwe[3], F Notzon[3].

1.Department of National Registration Passport Citizenship, Lusaka, Zambia;
2. Bloomberg Data for Health Initiative, Lusaka, Zambia;
3.International Statistics Division, Centre for Disease Control and Prevention, Hyattsvill, USA.

Citation style for this article: Nyahoda M , Banda J, Mwango C, Mukombwe B, Notzon F. Mortality and Cause of Death Profile for Deaths from the Civil Registration System: 2017 Facts and Figures. Health Press Zambia Bull. 2018;2(9); pp 17-25.

The Department of National Registration Passport and Citizenship is mandated to register vital events including deaths and causes of deaths. However, death registration is still low at less than 20 percent nationwide. About 65 percent of the deaths occur in health facilities while 35 percent take place outside health facilities. HIV was the leading cause of death, accounting for about 24 percent of all health facility deaths in 2017. Gestation and fetal growth disorders were the most common among children in the age group 0-4 years. With respect to non-communicable diseases, 29 percent of the deaths were caused by cardiovascular diseases. Road traffic accidents accounted for about 29 percent of the external causes of death.

I. Background

The Department of National Registration Passport and Citizenship (DNRPC) is the Civil Registration authority in Zambia, whose mandate is to register all vital events occurring in Zambia as established in the Births and Deaths Registration Act (Cap 51) of the laws of Zambia (1). Despite the legal basis of the system and 40 years of implementation, less than 20 percent of all deaths are registered (2). The Sample Vital Registration with Verbal Autopsy (SAVVY) reports that approximately 53 percent of deaths occur in health facilities and 47 percent outside of health facilities (3). Statistics on mortality and causes of death assist in the formulation of evidence-based health policies and decision-making as well as implementation of cost-effective health interventions (4).

II. Importance of Information on Cause of Death

Efforts are being made to increase death registration coverage in Zambia. Various interventions are being implemented with the support of cooperating partners, including the Bloomberg Data for Health Initiative (BD4HI). Training of medical doctors and ICD-10 Coders are among the interventions aimed at improving the quality of Cause of Death (COD) certification and coding, respectively. Currently, a pilot study on verbal autopsy which involves the collection of probable causes of death is taking place outside some selected health facilities in Lusaka. Such deaths are unlikely to be certified; hence, no health information is recorded. Other interventions on improving coverage include the improvement in health facility reporting of all deaths, use of village administrative systems to facilitate the registration of community deaths, reviewing of laws pertaining to death registration and the use of Enterprise Architecture (EA) to strengthen the processes in death registration. This paper presents findings on deaths occurring in health facilities. The deaths were routinely registered in 2017 and had Medical Certificates of Cause of Death (MCCDs).

III. Distribution of Deaths

Out of 29,164 routinely registered deaths in 2017 the majority, of deaths, occurred in health facilities accounting for 64.7 percent, 32.2 percent occurred outside health facilities and 0.3 percent occurred in others places such as hospices/ retirement homes.