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ESSENTIAL FEATURES

Trend of Malaria Cases and Deaths from 2015 to 2019 In Tanzania Mainland

Tanzania on Track to Achieve the End Tuberculosis Strategy 2020 Milestones

Tanzania Yafikia Malengo Mkakati ya Mwaka 2020 ya Kutokomeza Ugonjwa wa Kifua Kikuu

Performance Testing of Bio-digester System for Management of Placenta and Biodegradable Healthcare Waste

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ABSTRACT

Introduction: The Ministry of Health, Community Development, Gender, Elderly and Children uses the Integrated Disease Surveillance and Response (IDSR) strategy to monitor reportable diseases and conditions to detect and respond to the leading causes of illness, death, and disability. This paper reports the results of analysis of the cumulative IDSR data for the 6-month period of July to December 2020. Data were analyzed to assess regional performances in reporting data and to count the number of cases of each disease or condition by age, sex, month, and region.

Analysis: All 26 regions of Tanzania Mainland submitted weekly reports to the national level. The regions achieved an average of 91% in completeness (i.e., percentage of districts providing complete reports to national level) and 76% in timeliness (i.e., percentage of districts reporting on time to national level). Only two regions, Singida and Lindi, did not meet the national target of ≥80% for completeness. Nine regions met the national target of ≥80% for timeliness. Regional performance based on completeness and timeliness improved compared to the corresponding period of the previous year, July to December 2019, which was 71% for completeness and 61% for timeliness. This improvement suggests that Tanzania is improving its data capturing and early detection reporting system.

During the 6-month period, a total of 977,225 cases and 2,237 deaths were reported for all IDSR diseases and conditions. The most reported condition was diarrhea (n=513,021, 52%). Diarrhea, pneumonia, typhoid, and animal bites were reported in all months under review and in all 26 regions. Most cases (n=915,499, 94%) were reported among the population aged below five years. Diarrhea and pneumonia were reported in only the population aged below five years. Of the 2,237 reported deaths, most cases were caused by pneumonia (n=1,367, 61%) and diarrhea (n=650, 29%). Consequently, the population aged below 5 years had the highest number of deaths (n=2,081, 93%). The condition with the highest case fatality rate was sleeping sickness (African Trypanosomiasis); one person with suspected sleeping sickness died.

Conclusion: IDSR data analyzed for July to December 2020 (WHO epidemiological weeks 27-52) showed that regional performance, based on completeness and timeliness, improved when compared with the corresponding period of the previous year, July to December 2019. Completeness and timeliness averages met the national standard of ≥80%, which suggests that the MOHCDGEC is improving in data capturing, early detection, and reporting that guides immediate responses to control and prevent disease outbreaks. Given the high number of diarrhea and pneumonia cases and deaths among the population under five years, there is an urgent need for the MOHCDGEC to intensify preventive and treatment measures.

INTRODUCTION

The Ministry of Health, Community Development, Gender, Elderly and Children (MOHCDGEC) collects data for 13 reportable diseases and conditions using the Integrated Disease Surveillance and Response (IDSR) strategy. Data are electronically collected from health facilities at all administrative levels, published weekly, and monthly to facilitate detection of and response to the leading causes of illness, death, and disability in Tanzania. The present paper reports cumulative IDSR data for the 6-month period from July to December 2020, World Health Organization (WHO) epidemiological weeks 27 to 52. Data were analyzed to assess regional performance in terms of completeness and timeliness of reporting. Completeness of reporting is measured by the percentage of district facilities in the region submitting complete reports. Timeliness of reporting is measured by the percentage of district facilities in the region submitting reports on time. Data were used to count the cumulative number of cases and deaths of each disease or condition by age, sex, month, and region.

ANALYSIS

Regional Performance

All 26 regions of the Tanzania Mainland submitted weekly reports of selected priority reportable conditions to the national level. The overall performance for completeness and timeliness for the reporting period of July to December 2020 was 91% and 76% respectively (Table 1). Regional performance improved when compared to the corresponding period of the previous year, July to December 2019, which was 71% for completeness and 61% for timeliness. The month of August had the highest percentages for both completeness (97%) and timeliness (90%). The month of September had the lowest percentage for timeliness (55%).

Table 1: Average Timeliness and Completeness of Health Facility Reporting by Month, July – December 2020

Month	% of Completeness	% of Timeliness
July	95.4	87.1
August	96.7	90.1
September	91.0	55.1
October	93.7	83.7
November	87.0	71.8
December	82.0	67.2
Overall Performance	**90.9**	**76.2**

Figure summarizes regional performance. Only two regions, Singida and Lindi, did not meet the national target of ≥80% for completeness of reports. Nine regions met the national target of ≥80% for timeliness of reports. Dar es Salaam region had the highest percentage health facilities submitting complete (100%) and timely (94%) reports.

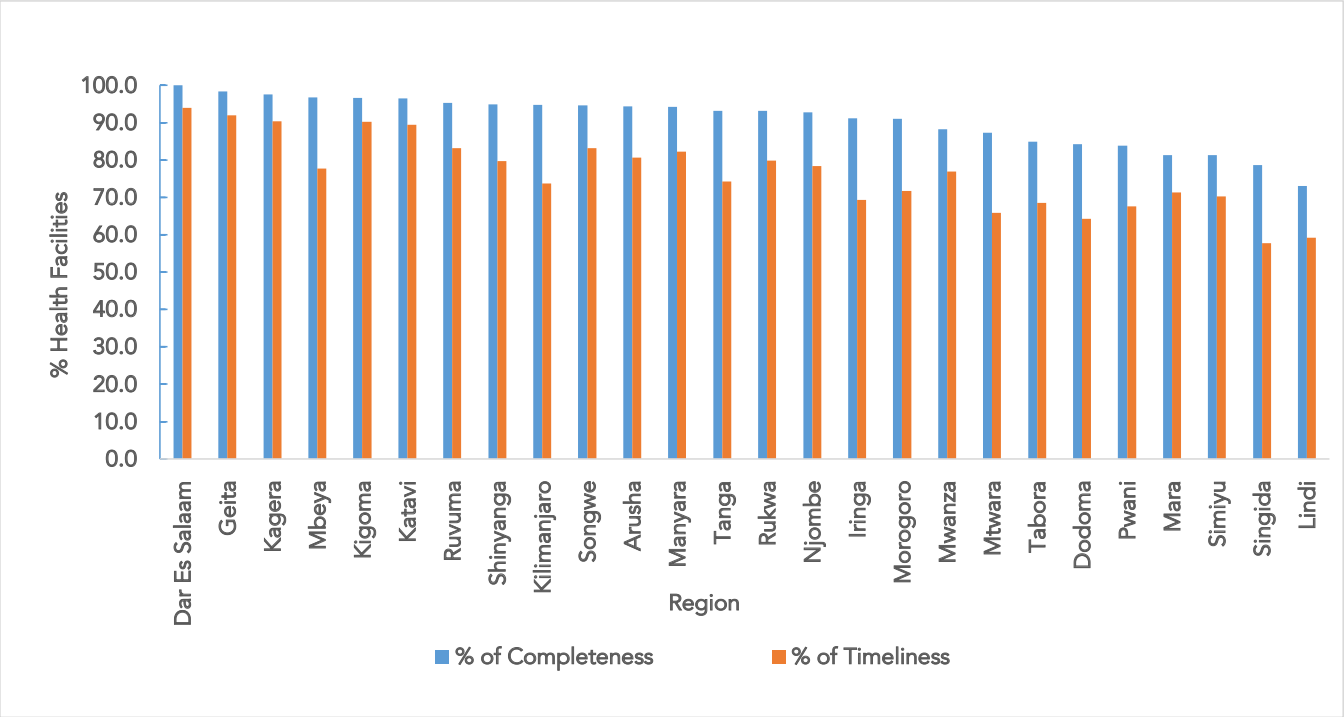

Figure: Percent of district health facilities providing complete and timely IDSR reports by region in Mainland Tanzania, July – December 2020

Distribution of cases and deaths

The total number of cases for all diseases and conditions reported via the IDSR from July to December 2020 was 977,225 of which more than half were diarrhea (n=513,021, 52%). Diarrhea and pneumonia were reported only for children below five years. The total number of deaths was 2,237 of which 2,081 (93%) were among those aged below 5 years and 1,367 (61%) were due to pneumonia. In the population aged 5 years and above, typhoid fever was the leading cause of death: 135 deaths out of 156 cases (87%). The condition with highest case fatality rate was sleeping sickness; one person with suspected sleeping sickness died (Table 2). The month of October had the highest number of cases (n=192,622, 20%). Cases of animal bites, diarrhea, pneumonia, and typhoid were reported every month (Table 3).

All 26 regions reported animal bites, diarrhea, pneumonia, and typhoid fever (Table 4). Dar es Salaam Region reported the highest number of animal bite cases (n=1,376, 8%) and diarrhea cases (n=41,156, 8%). Arusha reported the highest number of pneumonia cases (n=33,655, 9%), and Mbeya Region reported the highest number of typhoid fever cases (n=6,899, 10.5%). The case of sleeping sickness was reported from Arusha Region. Overall, Dar es Salaam Region reported the highest number of cases (n=74,964, 7.7%) (Table 3).

Table 2: Number of cases and deaths by age and sex for all diseases and conditions reported via the IDSR, July - December 2020

Condition/Disease		Total	Male <5 years n (%)	Female <5 years n (%)	Male ≥5 years n (%)	Female ≥5 years n (%)
Acute Flaccid Paralysis	Cases	17	6 (35)	2 (12)	7 (41)	2 (12)
	Deaths	0	0	0	0	0
Animal Bites	Cases	17,069	3,849 (23)	1,893 (11)	6,175 (36)	5,152 (30)
	Deaths	14	0	0	9 (64)	5(36)
Anthrax	Cases	7	2 (29)	1 (14)	4 (57)	0
	Deaths	0	0	0	0	0
Bloody Diarrhea	Cases	3	1 (33)	0	1 (33)	1 (33)
	Deaths	1	1 (100)	0	0	0
Cholera	Cases	77	9 (12)	16 (21)	27 (35)	25(32)
	Deaths	2	0	2 (100)	0	0

Condition/Disease		Total	Male <5 years n (%)	Female <5 years n (%)	Male ≥5 years n (%)	Female ≥5 years n (%)
Cerebrospinal Meningitis	Cases	7	0	0	6 (86)	1 (14)
	Deaths	3	0	0	3 (100)	0
DengueFever	Cases	7	2	0	5	0
	Deaths	0	0	0	0	0
Diarrhoea	Cases	513,021	259,699 (51)	253,322 (49)	0	0
	Deaths	650	458 (70)	192 (30)	0	0
Measles	Cases	62	27 (44)	11 (18)	14 (23)	10 (16)
	Deaths	0	0	0	0	0
Pneumonia	Cases	381,421	194,596 (51)	186,825 (49)	0	0
	Deaths	1,367	854 (62)	513 (38)	0	0
Rabies	Cases	10	1 (10)	2 (20)	4 (40)	3 (30)
	Deaths	4	0	0	3 (75)	1 (25)
Trypanosomiasis	Cases	1	1 (100)	0	0	0
	Deaths	1	1 (100)	0	0	0
Typhiod	Cases	65,523	11,823 (18)	3,411(5)	22,467 (34)	27,822 (42)
	Deaths	195	26 (13)	34 (17)	90 (46)	45 (23)
Total	**Cases**	**977,225**	**470,016 (48)**	**445,483 (46)**	**28,710 (3)**	33,016 (3)
	Deaths	**2,237**	**1,340 (60)**	**741 (33)**	**105 (5)**	51 (2)

Table 3: Number of cases and deaths by month for all diseases and conditions reported via the IDSR, July - December 2020

Condition / Disease	July		August		September		October		November		December		Total		CFR* (%)
	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	
Accute Flaccid Paralysis	12	0	3	0	1	0	0	0	1	0	0	0	17	0	0
Animal Bites	3,285	2	2,862	2	2,578	0	2,997	2	2,512	3	2,835	5	17,069	14	0.1
Anthrax	5	0	2	0	0	0	0	0	0	0	0	0	7	0	0
Bloody Diarrhea	1	0	2	1	0	0	0	0	0	0	0	0	3	1	33.3
Cholera	0	0	0	0	0	0	0	0	59	2	18	0	77	2	2.6
Cerbrolspinal meningitis	3	1	2	2	2	0	0	0	0	0	0	0	7	3	42.9
Dengue Fever	7	0	0	0	0	0	0	0	0	0	0	0	7	0	0
Diarrhea	91,717	107	86,918	91	84,241	108	102,844	131	72,108	104	75,193	109	513,021	650	0.1
Measles	44	0	13	0	5	0	0	0	0	0	0	0	62	0	0
Pneumonia	72,293	280	61,176	226	57,149	193	74,244	295	54,716	201	61,843	172	381,421	1,367	0.4
Rabies	4	2	3	2	2	0	1	0	0	0	0	0	10	4	40
Trypanosomiasis	0	0	0	0	0	0	0	0	1	1	0	0	1	1	100
Typhoid	12,771	37	10,653	44	9,934	24	12,536	20	9,460	26	10,169	44	65,523	195	0.3
Total	180,142	429	161,634	368	153,912	325	192,622	448	138,857	337	150,058	330	977,225	2,237	

*CFR – Case fatality rate

Table 4: Number of cases by region for all diseases and conditions reported via the IDSR, July - December 2020

Region	AFP*	Animal bite	Anthrax	Bloody Diarrhea	Cholera	CSM†	Dengue Fever	Diarrhea	Measles	Pneumonia	Rabies	Trypano-somiasis	Typhoid	Total
Arusha	11	1,084	7	0	0	0	0	21,331	8	33,655	0	1	1,990	58,087
Dar es Salaam	0	1,376	0	0	0	0	1	41,156	0	27,666	0	0	4,765	74,964
Dodoma	0	1,307	0	0	0	0	0	29,237	0	19,203	0	0	5,336	55,083
Geita	1	555	0	0	0	0	0	18,202	0	8,172	0	0	1,806	28,736
Iringa	0	654	0	0	0	0	0	9,563	0	8,485	0	0	1,804	20,506
Kagera	0	387	0	2	0	0	0	21,558	0	13,152	1	0	1,427	36,527
Katavi	0	185	0	1	0	0	0	8,885	0	3,363	0	0	1,017	13,451
Kigoma	0	556	0	0	77	7	0	32,056	49	15,320	4	0	1,453	49,522
Kilimanjaro	0	1,057	0	0	0	0	0	10,400	0	22,711	1	0	2,163	36,332
Lindi	0	268	0	0	0	0	0	10,722	0	6,597	0	0	1,827	19,414
Manyara	0	1,159	0	0	0	0	0	24,719	0	32,890	0	0	3,048	61,816
Mara	0	709	0	0	0	0	0	13,969	0	12,098	0	0	1,520	28,296
Mbeya	0	810	0	0	0	0	0	25,935	0	19,289	0	0	6,899	52,933
Morogoro	0	1,132	0	0	0	0	0	24,507	0	19,104	0	0	4,502	49,245
Mtwara	2	343	0	0	0	0	0	13,856	0	9,237	1	0	901	24,340
Mwanza	0	799	0	0	0	0	0	28,180	0	16,004	0	0	1,779	46,762
Njombe	0	170	0	0	0	0	0	6,096	5	6,200	0	0	4,348	16,819
Pwani	0	833	0	0	0	0	0	12,937	0	10,989	0	0	1,078	25,837
Rukwa	0	458	0	0	0	0	0	23,747	0	9,834	0	0	3,172	37,211
Ruvuma	0	838	0	0	0	0	0	15,394	0	11,541	0	0	2,907	30,680
Shinyanga	1	357	0	0	0	0	0	16,574	0	11,244	1	0	1,239	29,416
Simiyu	1	223	0	0	0	0	0	18,396	0	9,897	2	0	1,041	29,560
Singida	0	636	0	0	0	0	0	18,177	0	8,725	0	0	3,088	30,626
Songwe	0	162	0	0	0	0	0	19,682	0	8,828	0	0	3,480	32,152
Tabora	1	518	0	0	0	0	0	28,189	0	16,312	0	0	1,928	46,948
Tanga	0	493	0	0	0	0	6	19,553	0	20,905	0	0	1,005	41,962
Total	17	17,069	7	3	77	7	7	513,021	62	381,421	10	1	65,523	977,225

*AFP – Acute Flaccid Paralysis (suspected polio)

†CSM – Cerebrospinal meningitis

CONCLUSION

IDSR data analyzed for July to December 2020 (WHO epidemiological weeks 27-52) showed that regional performance, based on completeness and timeliness, improved when compared with the corresponding period of the previous year, July to December 2019. Completeness and timeliness averages met the national standard of ≥80%, which suggests that the MOHCDGEC is improving in data capturing, early detection, and reporting that guides immediate responses to control and prevent disease outbreaks. There is an urgent need for the government to intensify preventive and treatment measures for diarrhea and pneumonia, which were among the leading causes of death in children aged below five years.

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MUHTASARI

Mkakati wa Ufuatiliaji na Udhibiti wa Magonjwa ya Mlipuko (IDSR): Ripoti ya miezi Sita, Julai –Desemba 2020 (wiki ya 27 hadi 52 za Shirika la Afya Duniani (WHO)

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Utangulizi: Wizara ya Afya, Maendeleo ya Jamii, Jinsia, Wazee na Watoto hutumia mkakati wa Ufuatiliaji na Udhibiti wa Magonjwa ya Mlipuko (IDSR) kufuatilia magonjwa na hali zinazoripotiwa kugundua na kudhibiti magonjwa ambayo ni chanzo cha vifo, na ulemavu. Makala hii inaripoti matokeo ya uchambuzi wa taarifa za IDSR kwa kipindi cha miezi 6 ya Julai hadi Desemba 2020. Takwimu zilichambuliwa kutathmini utendaji wa mkoa katika katika utoaji wa taarifa na kufahamu idadi ya visa vya kila ugonjwa au hali kulingana na umri, jinsia , mwezi, na mkoa.

Uchambuzi: Mikoa yote 26 ya Tanzania Bara iliwasilisha ripoti za kila wiki kwa ngazi ya kitaifa. Mikoa ilipata wastani wa asilimia 91 kwa ukamilifu (yaani, asilimia ya wilaya zinazotoa ripoti kamili kwa ngazi ya kitaifa) na asilimia 76 kwa wakati unaofaa (ufanisi) (kwa mfano, asilimia ya wilaya zinazoripoti kwa wakati kwa ngazi ya kitaifa). Mikoa miwili tu, Singida na Lindi, haikuweza kufikia lengo la kitaifa la asilimia 80 ama zaidi (≥80%) kwa ukamilifu. Mikoa tisa ilifikia lengo la kitaifa la asilimia 80 ama zaidi kwa wakati unaofaa. Utendaji wa mikoa kulingana na ukamilifu na ufanisi ulioboreshwa ikilinganishwa na kipindi kinacholingana cha mwaka uliopita, Julai hadi Desemba 2019, ambayo ilikuwa asilimia 71 kwa ukamilifu na asilimia 61 ufanisi. Mafanikio haya yanaonyesha kuwa Tanzania imeboresha mfumo wake wa unasaji na utoaji taarifa mapema.

Katika kipindi cha miezi 6, katika mpango wa IDSR kwa magonjwa yanayopewa kipaumbele kutolewa taarifa, jumla ya matukio 977,225 na vifo 2,237 viliripotiwa. Ugonjwa ulioripotiwa zaidi ilikuwa kuhara (n = 513,021, asilimia 52). Matukio ya kuhara, homa ya mapafu, homa ya matumbo, na kuumwa na wanyama viliripotiwa katika miezi yote 6 na katika mikoa yote 26. Matukio mengi (n = 915,499, 94%) yaliripotiwa katika kundi la watu walio chini ya miaka mitano. Kuhara na homa ya mapafu viliripotiwa tu kwa kundi la watu walio chini ya miaka mitano. Kati ya vifo 2,237 vilivyoripotiwa, visa vingi vilisababishwa na homa ya mapafu (n = 1,367, asilimia 61) na kuhara (n = 650, asilimia 29)

Kwa hivyo, kundi la watu walio chini ya umri wa miaka 5 walikuwa na idadi kubwa zaidi ya vifo (n = 2,081, asilimia 93). Ugonjwa uliokuwa na kiwango cha juu cha vifo ilikuwa ugonjwa wa malale (African Trypanosomiasis/sleeping sickness); mtu mmoja aliye kushukiwa kuwa na ugonjwa wa malale alikufa.

Hitimisho: Takwimu za IDSR zilizochambuliwa kwa kipindi cha Julai hadi Desemba 2020 (wiki za magonjwa ya WHO 27-52) zilionyesha kuwa utendaji katika mikoa, kulingana na ukamilifu na ufanisi, uliboreka ikilinganishwa na kipindi kinacholingana cha mwaka uliopita, Julai hadi Desemba 2019. Kwa wastani Ukamilifu na Ufanisi ulifikia kiwango cha lengo la kitaifa cha aslimia 80 au zaid (≥80%), kitu ambacho kinaonyesha kwamba MOHCDGEC imeboresha mfumo wa unasaji wa takwimu, ugunduaji wa mapema, na utoaji wa ripoti ambayo inatoa mwongozo wa utekelezaji wa haraka wa kudhibiti na kuzuia milipuko ya magonjwa.Kwa kuzingatia idadi kubwa ya visa vya kuhara na homa ya mapafu na vifo vingi katika kundi la watu chini ya miaka mitano, kuna haja ya MOHCDGEC kuimarisha hatua za kinga na matibabu.

Trend of Malaria Cases and Deaths from 2015 to 2019 in Tanzania Mainland

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ABSTRACT

Introduction: Malaria is a mosquito-borne infectious disease that can cause severe morbidity and mortality. In Tanzania, malaria is among the leading causes for over a decade. However, from 2015 to 2019, a decrease in malaria cases and deaths was noted. This paper reports trends of malaria cases and deaths for a five-year period (2015-2019) in Tanzania Mainland.

Methodology: A retrospective cross-sectional survey was conducted in mainland Tanzania to assess trends in the number of cases and deaths due to malaria over a five-year period (2015-2019). Data included all malaria cases and deaths reported in the District Health Information System (DHIS2). A checklist for data extraction included number of cases and deaths and region of residence. Investigators were trained to extract data from the DHIS2 system. Permission to conduct the study was approved by Ministry of Health, Community Development, Gender, Elderly and Children through the National Malaria Control Program.

Results: A total of 32,363,798 cases and 20,858 deaths due to malaria were recorded during the reporting period. Malaria incidence (new cases) was highest in 2015 (163 cases/1,000 population). The incidence was lowest in 2017 (109 cases/1,000 population). The average rate of death due to malaria during the five-year period was 7 per 100,000 population. In 2015 the average death rate was 11.5 per 100,000 population. In 2019, the death rate was 3.2 per 100,000 population a decrease of 8.3 per 100,000 population. This decrease was found to be statistically significant (p-value, <0.001).

Conclusion: Remarkable decreases in malaria incidence and death rates were observed nationally from 2015 to 2019 with at least twenty percent

of high malaria incidence regions transitioned to low incidence regions. This decline is strongly linked to the scale-up and utilization of malaria control and preventive measures including long-lasting insecticide-treated nets, in-door residual spraying, larvicides, and improvement in case management using artemisinin-based combination therapy as an effective antimalarial drug. Therefore, Tanzania free from malaria is possible if Government and partner determination and commitments to achieve elimination then eradication are sustained.

Key Words: Malaria, Trend, Cases, Deaths, Tanzania

INTRODUCTION

According to the 2019 World Malaria Report by the World Health Organization (WHO), there were 229 million cases of malaria globally, and Tanzania was ranked 11th among countries with the highest burden contributing 3% to the global malaria cases [1,2].

The estimated number of world malaria deaths stood at 435,000 in 2017 (2) According to Health Management Information System (HMIS) that compiles data via District Health Information Software 2 (DHIS2), Tanzania reported 3,684 malaria deaths in 2017, which is less than 1% of the total malaria deaths that were reported globally. According to a ten-year (2006-2015) retrospective cause of death analysis conducted by the Tanzania National Institute for Medical Research, malaria was a leading cause of death with 31,733 (12.8%) deaths due to malaria out of the total 247,976 deaths captured via DHIS2 [3]. Trends of malaria cases and deaths have not been published since 2015. Therefore, the present paper reports findings of an investigation conducted to ascertain whether there is a decrease in the number of cases and deaths due to malaria for a period of five years (2015 – 2019) in mainland Tanzania. Reported malaria cases and deaths supports the World Health Organization's global target of reducing malaria incidence and mortality rates by 90% by 2030 [4].

METHODOLOGY

Design and data collection procedures

This retrospective cross-sectional study was conducted in mainland Tanzania to assess malaria incidence and death rates. Data for all reported malaria cases and deaths for the five-year period, 2015 – 2019, were retrieved from the DHIS2 system and analyzed. A checklist data to retrieve included time (in years and months), the number of cases and deaths and geographical location (region of residence). In estimating the burden of malaria, regions with malaria incidence rate of less than 50 cases per 1,000 population were considered low malaria burden, and regions with 51 or more people with malaria per 1,000 population were high malaria burden regions.

Investigators were trained to extract data from the DHIS2 system. Approval for conducting this exercise was granted by the Ministry of Health, Community Development, Gender, Elderly and Children (MoHCDGEC), through the National Malaria Control Program (NMCP).

Data analysis

Data were entered, cleaned and analyzed using Epi Info™ 7. The mean differences of malaria death rate between high and low burden regions was calculated using two sample t test, and the trend of malaria deaths between 2015 and 2019 was calculated using paired sample t test. The p-value of <0.05 was considered as statistical significant.

RESULTS

Malaria case and death rate

A total of 32,363,798 malaria cases were extracted from the DHIS2 system for the five-year period. The mean number of annual cases was 6,472, 759. The highest number of cases was observed in 2015 (n= 7,738,576 (23.9%)), and the lowest number of cases was observed in 2017 (n= 5,595,919 (17.3%)). A total of 20, 858 deaths due to malaria (presumptive and confirmed) were captured and recorded in the period under review. On average, 4,171 deaths were recorded each year. The highest number of deaths (n=6, 780) was recorded in 2015 and lowest number of deaths was recorded in 2019 (n=2,111) (Figure 1).

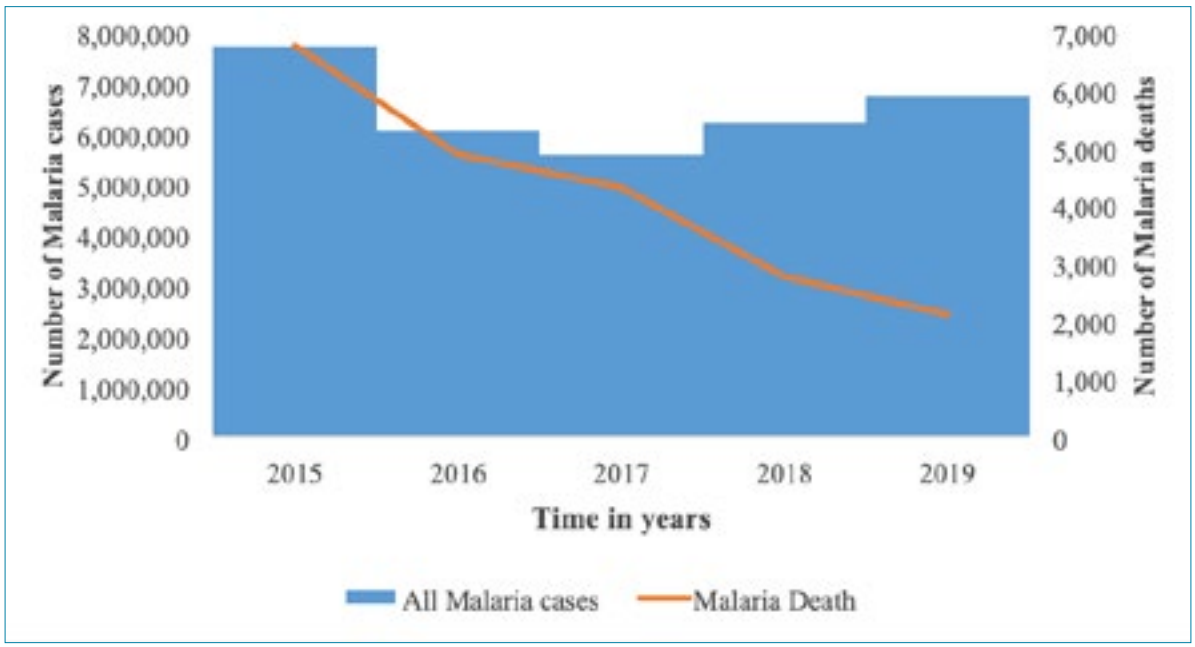

Figure 1: Number of annual malaria cases and deaths recorded from 2015 to 2019, Tanzania Mainland

The months of June and July 2015 were the months with most cases recorded, accounting for 10.4% (n=804,979) and 9.8% (n=761,341) of all cases that has occurred in 2015 respectively. On the other hand, September 2017 was the month with least number of cases accounting for 5.9% (n=327,501) of all cases that occurred in 2017. Of 20,858 malaria deaths captured in the studied period, about 84% (n=17,465) were confirmed to be due to malaria. The remainders were presumptively reported. As presented in Figure 2, July 3.89% (n=683), June 3.53% (n=619) and May (542) of 2015 were the months with highest number of deaths reported in the five-year period.

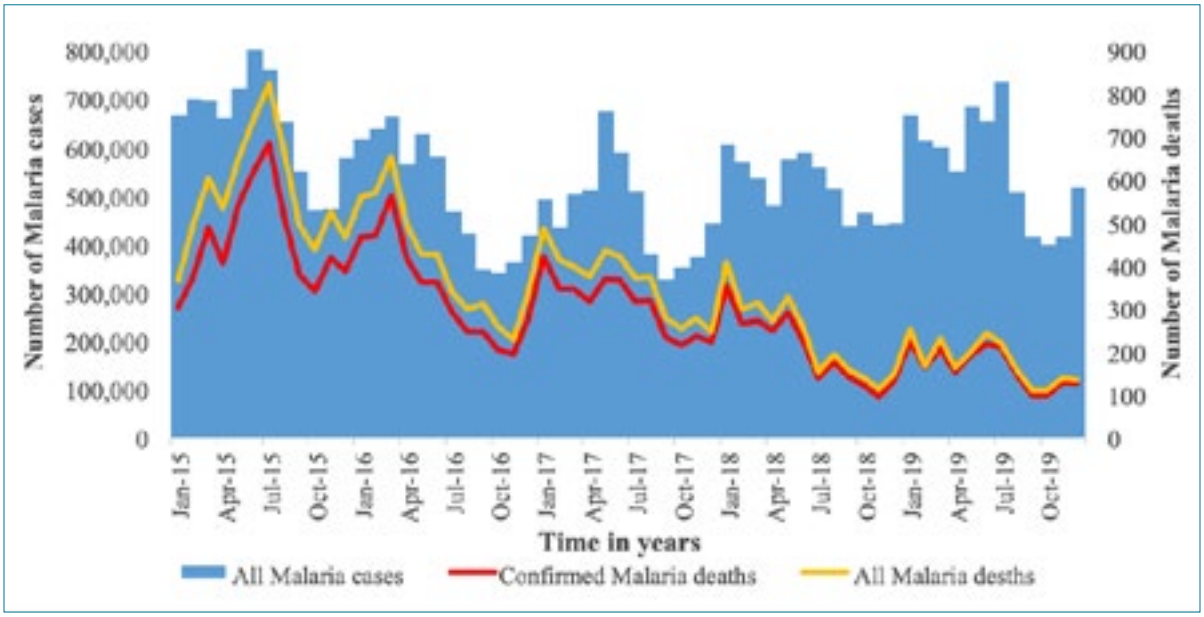

Figure 2: Number of Malaria cases and deaths on monthly bases from 2015 to 2019

Malaria incidence and death rates

Malaria incidence (new cases) was high in 2015, whereby in every 1,000 population, 163 cases of malaria. The incidence was lowest in 2017 of which, 109 cases of malaria were reported in every 1,000 population. On average, in the period of five years under review, the incidence of malaria was 127 cases in every 1,000 population. The average rate of death due to malaria, confirmed deaths per 100,000 population was 7.0 with highest and lowest death rate observed to be 11.3 and 3.6 in 2015 and 2019 respectively as showed in Figure 3. The peak death rate was observed in July (16.8), June (15.7) and May (13.3) in 2015 and lowest death rate observed was in September and October 2019 each with rate of 2 (Figure 4).

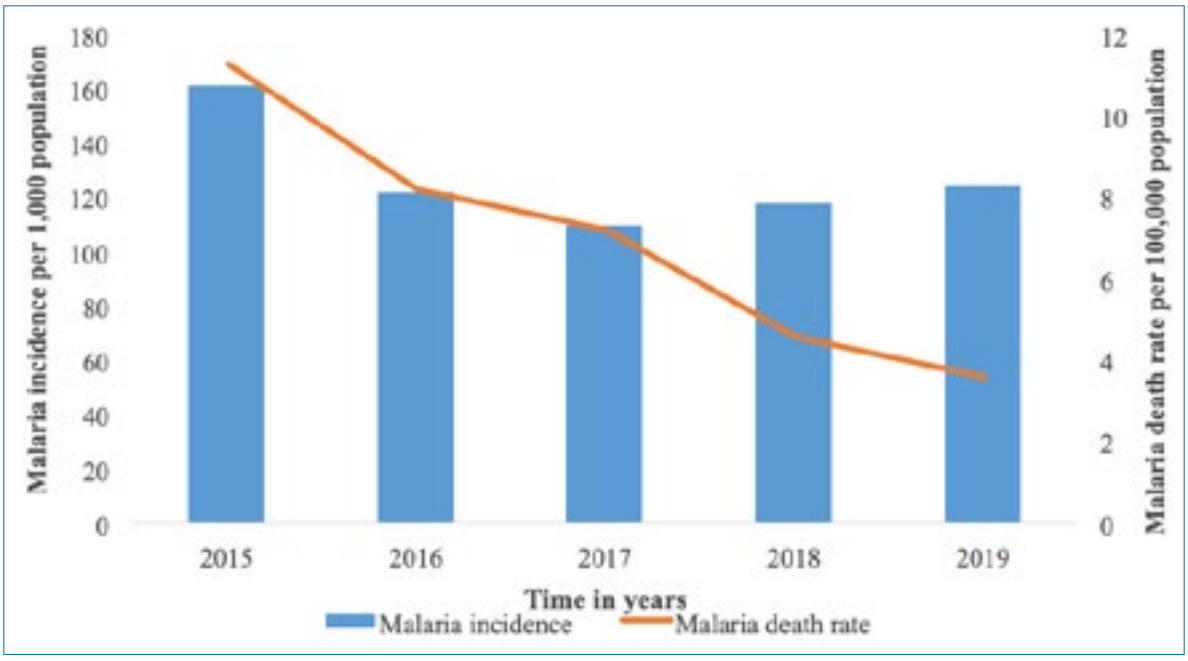

Figure 3: Annually Malaria incidence per 1000 and death rate per 100,000 population from 2015 to 2019

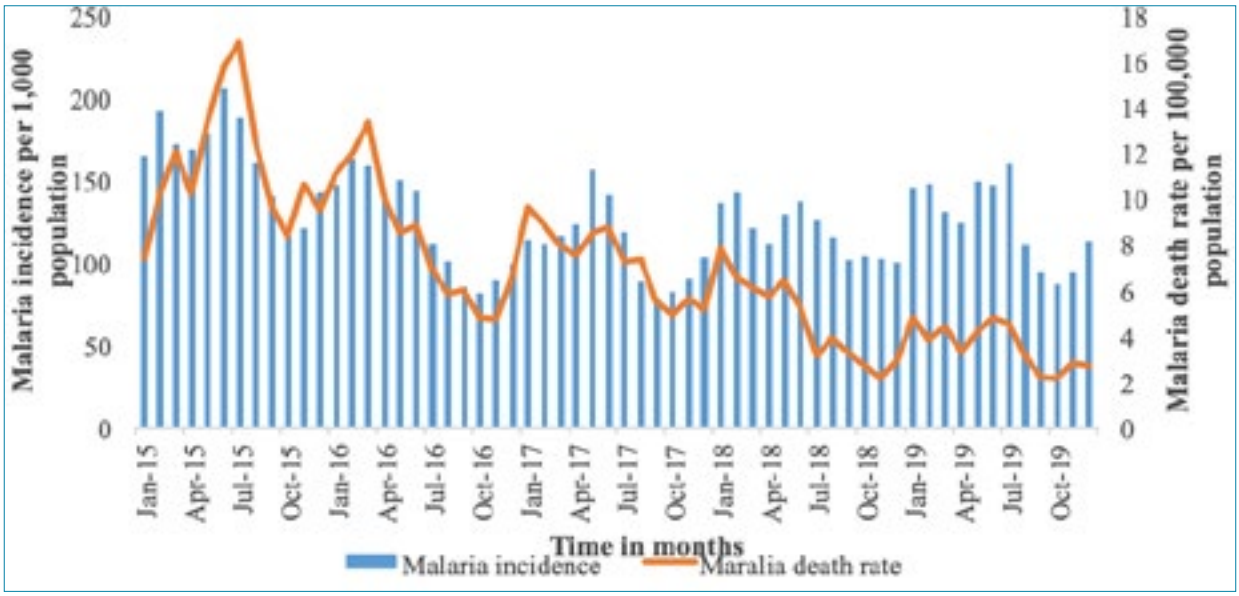

Figure 4: Monthly Malaria incidence per 1,000 population and death rate per 100,000 population from 2015 to 2019

Table 1 summarizes the incidence rates of malaria cases for the period under review, 2015-2019. Throughout the period, Pwani and Mtwara regions had malaria incidence of more than 200 cases per 1,000 population. Seven regions (27%) in 2015 had incidence of less than 50 cases per 1,000 population: Arusha (6.2), Kilimanjaro (14.8), Njombe (24), Manyara (26.5), Iringa (31.5), Songwe (35.1) and Singida (49). In 2019, the following 6 regions had malaria incidence of more than 200 cases per 1,000 population: Mtwara (353.2), Pwani (297), Kigoma (290.3), Lindi (282.4), Ruvuma (241.3) and Tanga (218.2). However, 11 regions 42%) in 2019 had incidence of less than 50 cases per 1,000 population. These regions include Arusha (3.4), Kilimanjaro (4.3), Manyara (5.1), Iringa (14.3), Dodoma (15.4), Simiyu (23.2), Singida (23.3), Songwe (29.7), Dar es Salaam (47.1) and Mbeya (49.8).

Information related to malaria death rate in respective region captured show that in the year 2015, 50% of regions (13) had malaria death rate of 10 or more per 100,000 population. Shinyanga (27.4), Mara (26.5), Rukwa (22.5), Kigoma (19.8) and Lindi (18.8) regions were the leading with most malaria death rate. Only five regions had malaria death rate of less than 5 per 100,000 population namely, Arusha (0.8), Kilimanjaro (1), Manyara (2.7) and Morogoro (3.2). In 2019, Katavi was the region with most deaths due to malaria (15 death per 100,000 population) and least were Arusha and Kilimanjaro each with 1 death per 100,000 population as presented in Figure 5 and summarized in Table 2.

Table 1: Malaria incidence by region per 1,000 population from 2015 to 2019

<50	50 – <100	100 – <150	150 – <200	200 and more

Region map	2015	2016	2017	2018	2019
Arusha	6.2	3.3	2.2	3.1	3.4
Dar Es Salaam	120.3	94.9	71.6	57.6	47.1
Dodoma	58.5	38.3	19.5	29.4	15.4
Geita	118.2	118.2	122.2	179	182.5
Iringa	31.5	29.8	13.4	18.1	14.3
Kagera	157.3	148.1	216.2	161.8	185.6
Katavi	137.1	86.9	92.1	132.6	165.9
Kigoma	161.3	166.1	249.2	279.5	290.3
Kilimanjaro	14.8	8.1	4.6	4.4	4.3
Lindi	189.5	270.8	326.7	239.2	282.4
Manyara	26.5	13.9	4.6	6.7	5.1
Mara	179.5	141.2	104.9	102.2	131
Mbeya	59	35.4	38.3	52	49.8

Morogoro	153.7	117.5	118.1	146.3	155.4
Mtwara	220.8	273.2	309.7	296.4	353.2
Mwanza	132	94	96.4	105.7	120.9
Njombe	24	20.5	21.8	21.9	24.3
Pwani	314.4	264.2	222.4	274.8	297
Rukwa	92.2	57.7	73.8	91	101
Ruvuma	163	187.3	245.3	216.9	241.3
Shinyanga	139.5	119.7	89.1	125.1	122.7
Simiyu	75.3	59.4	43.3	26.6	23.2
Singida	49	41.8	19	35.3	23.3
Songwe	35.1	21.7	20.8	24	29.7
Tabora	139.6	153	109.5	191.9	180.4
Tanga	164.7	151.6	125.1	216.4	218.2

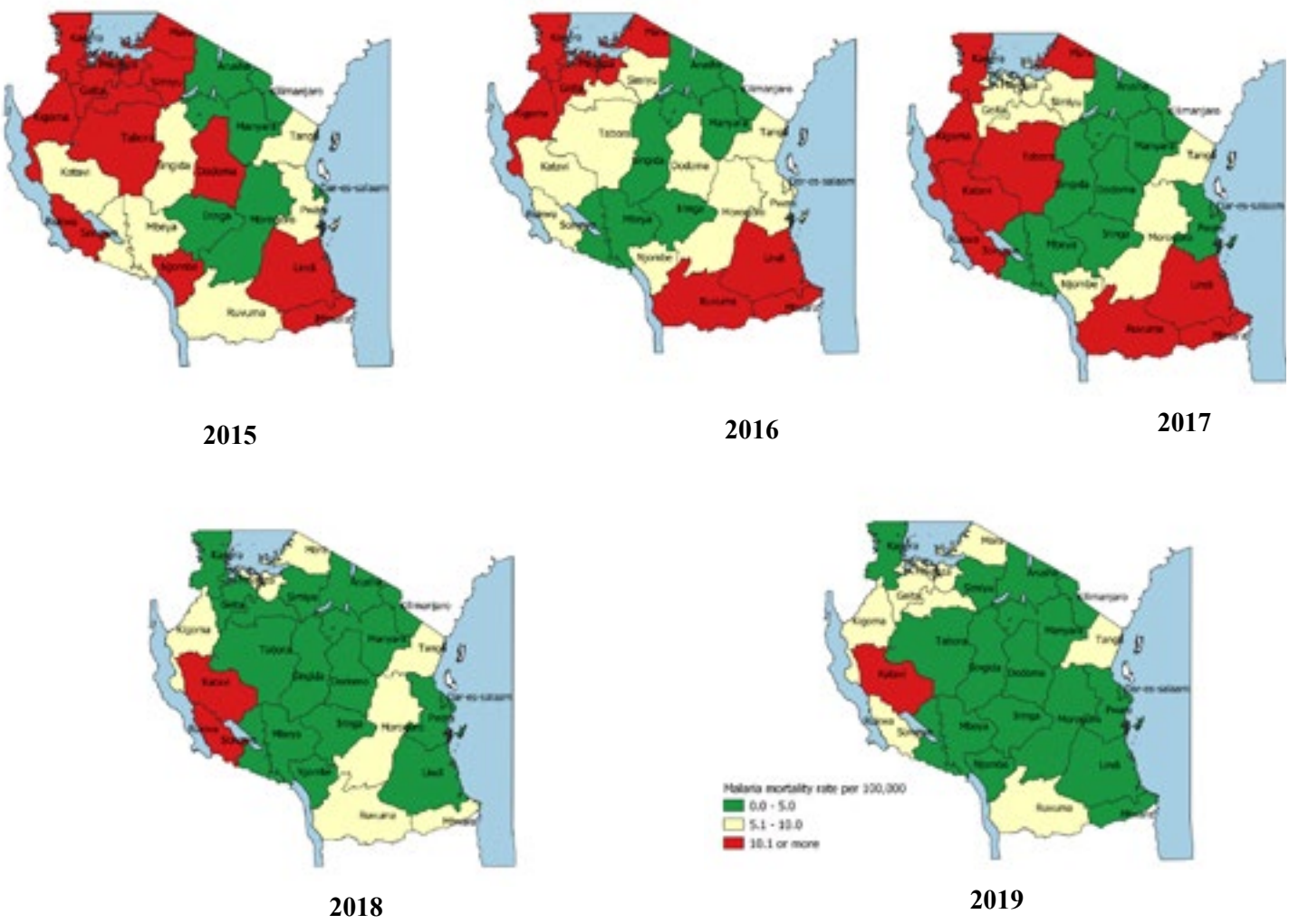

Figure 5. The trends of malaria mortality rate in mainland Tanzania (2015 – 2019)

Table 2: Malaria death rate by region per 100,000 population from 2015 to 2019

0 – <5	5 – <10	10 and more

Region Map	2015	2016	2017	2018	2019
Arusha	0.8	0.6	0.6	0.3	0.1
Dar-es-salaam	3.7	5.3	3.4	1.3	1.2
Dodoma	12	5.6	2.7	3	0.5
Geita	11	14.1	5.8	4.1	7.3
Iringa	5	2.9	2.5	2.6	1.2
Kagera	18.6	12.9	11.4	4.7	4.3
Katavi	8.4	5.9	27.3	20.7	15
Kigoma	19.8	13.3	14.2	7.3	7
Kilimanjaro	1	0.4	0.1	0.3	0.1
Lindi	18.8	20.6	10.5	4.5	3.3
Manyara	2.7	1.6	0.9	1.1	0.6
Mara	26.5	12.7	14.7	6.3	6.4
Mbeya	7.8	4.5	3.1	2.4	0.5
Morogoro	3.2	7	7.8	6.9	2.7
Mtwara	19	14.7	13	8	4.7
Mwanza	18.2	10.2	7.9	6.5	5.4
Njombe	10.1	9.1	5.7	2	0.9
Pwani	6.8	9.1	3.5	2.8	2.2
Rukwa	22.5	9.7	16.1	13.3	5.8
Ruvuma	9.4	17.4	12.3	8.9	4
Shinyanga	27.4	9	8.6	4.6	5.1
Simiyu	11.7	7.5	6.5	2.2	2.6
Singida	7.4	3.5	2	4.5	1
Songwe	5.9	4.5	2.1	2.7	2.3
Tabora	11.1	5.6	10.6	4.8	4.7
Tanga	8.8	9.5	6.8	7.2	4

Malaria Burden

In the year 2015, seven regions were low-burden and on average of eight people in every 100,000 population (range from 1.4 to 14.6 per 100 000 population) died due to malaria. The remaining 19 regions were high-burden with average death rate of 12.7 (range from 5 to 20.5 per 100 000 population). On average the difference of death due to malaria between the two groups (the high burden and low burden) was not statistically significant (p=0.158). In 2019, 11 regions were low burden and on average about 4 people died due to malaria per 100,000 population (range from 1 to 8.2 per 100,000 population) while 15 regions that were high-burden had average death rate of 3.6 per 100,000 population (range from 1.7 to 5.4 per 100,000 population). The average difference of death rate was not statistically significant (p=0.972).

The trends of death due to malaria per 100,000 population was assessed in each region for the 5-year period. In 2015, the average death rate was 11.5 per 100,000 population and in 2019 was 3.2 per 100,000 population. This shows that, in the period of 5 years the average death rate had decreased by 7.87 per 100,000 population. This decrease was found to be statistically significant (p-value, <0.001). Table 3 summarizes the findings.

Table 3: The mean differences of Malaria death rate between high and low burden regions

Region	n	Mean **(SD)**	**Mean Difference (SD)**	**95% CI**	**p-value**
2015				(Min-Max)	
High	19	12.74 **(7.74)**	4.81	-1.99 – 11.62	**0.158***
Low	7	7.93 (6.54)			
2019					
High	15	3.55 **(1.86)**	-0.05	-2..75 – 2.65	**0.972***
Low	11	3.60 **(4.60)**			
Overall					
Rate 2015	26	11.45 **(7.63)**	7.87	5.13 – 10.61	**<0.001****
Rate 2019	26	3.57 **(3.23)**			

**Mean comparison test (t-test) two sample using groups*

***Paired sample t-test*

DISCUSSION

Malaria case incidence has fallen globally since 2010 but the rate of decline has stalled and even increased in some region since 2014 [1]. However, in our study we observed a decline in malaria case incidence rate and malaria associated death rate from 2015 to 2019. A bi-modal trend has been observed were most of cases and deaths were seen between January and March (with February usually being the peak) and between May and July (June being the peak) in each year. This is in contrast compared to the study conducted in Ethiopia where majority of their cases were observed between October and December described as late transition and between May and June described as early transition [5]. This variation can be due to difference in seasonality between the two countries where these studies were conducted, but in both observations the reason remain the same that, the peak cases seen corresponded to rainy season. In Tanzania where this study was conducted, the short rainfall that usually start around October – December each year and the long rainfall season "Masika" that usually starts in March to May provide suitable breeding habitat for vector mosquito responsible for malaria transmission [6–8].

It was observed that confirmed malaria cases outnumbered the presumptive, which accounted for at least 84% of all malaria cases diagnosed in the period of 2015 to 2019. World Malaria report of 2016, showed more than 74% of malaria cases reported in Tanzania were confirmed [9]. The increase in confirmed cases is due to continued Government efforts to ensuring availability of quality assured diagnostic tests. The efforts are aligned with WHO recommendation that in any case where malaria is suspected, it should be confirmed by Rapid Diagnostic Test (RDT) or by examination of blood slide under the microscope for malaria parasite detection before treatment. Rapid Diagnostic Test (RDT) offers a useful alternative to microscopy in situation where microscopic diagnosis is unrealizable helping in improving of case management. This has resulted into rational antimalarial drug use, hence reducing the risk of facilitating the development of drug resistance.

This study observed that 2015 was the year with a greater number of deaths (8,793) compared to subsequent years (4,047 deaths in 2019). This decrease was found to be highly statistical significant (p-value <0.001). This correlates with pattern observed by WHO in the period of 2015 to 2019 [1].

The decrease in deaths observed might be a true decrease in malaria death rate due to decrease in malaria cases as a result of up-scaling of malaria control and preventive measures countrywide such as the wide usage of LLITNs, application of larvicides, Indoor Residual Spraying (IRS) and improvement in case management using effective antimalarial drugs. On the other hand, the decrease could be associated with a decrease in presumptive cases, as a majority of deaths that occurred in 2015 (16.6%) were presumptive cases while in 2019 only 8.5% of death were presumptive. This means that there is a likelihood that deaths occurred in 2015 were wrongly labeled to be due to malaria as might have been caused by other health illnesses given the fact that malaria were presumptively diagnosed.

The mean differences of malaria death rates between high- and low-burden regions were assessed for all years and in year 2015, it was found to be not statistically significant (p-value 0.158). This result is due to the fact that in 2015 both high- and low- burden regions had a large average death rate per annum. In the year 2019, the mean difference of death rates between high- and low- burden regions was also not statistically significant (p-value 0.972) because both showed decreases in their mean death rates. The observed decline of malaria morbidity and malaria related deaths in Tanzania for the period under review could be a result of enhanced implementation and utilization of malaria control measures over the past decade [10].

The mean difference of average annual death rate of each region was assessed individually in the period of five years and it was found that there was a highly statistical significant (p-value <0.001) decrease in mean death rate among regions. Although Katavi Region had a high death rate in 2019 (15 per 100,000 population), it was low compared to Shinyanga, which was the highest in year 2015 (27.4 per 100,000 population).

CONCLUSSION

A remarkably decrease in malaria incidence and death rates was observed nationally from 2015 and 2019 with at least twenty percent of high-malaria regions transitioning to low-malaria regions. This decline is strongly linked to the scale-up and utilization of malaria control and preventive measures including LLITNs, IRS, larvicides and improvement in case management using Artemisinin-based Combination Therapy (ACT). Tanzania free from malaria seems possible, if Government and partners continue commitments to the ongoing malaria preventive and control efforts to achieve elimination then eradication.

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MUHTASARI
Mwenendo wa Visa na Vifo vya Malaria Kutoka 2015 Hadi 2019 kwa Tanzania Bara

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Utangulizi: Malaria ni ugonjwa wa kuambukiza unaoenezwa na mbu ambao unaweza kusababisha maradhi na vifo. Nchini Tanzania, malaria ni miongoni mwa magonjwa yanayoongoza kusabisha vifo kwa zaidi ya muongo mmoja. Hata hivyo, kutoka mwaka 2015 hadi mwaka 2019, kumebainika kuwa na upungufu wa visa na vifo vya malaria. Makala hii linaripoti mwenendo wa visa na vifo vya malaria kwa kipindi cha miaka mitano (2015-2019) kwa Tanzania Bara.

Mbinu: Uchambuzi wa taarifa za wagonjwa zilizohifadhiwa kwenye kanzidata ya takwimu ulifanyika kwa Tanzania Bara kutathmini mwenendo wa idadi ya visa na vifo vinavyotokana na malaria kwa kipindi cha miaka mitano (2015-2019). Takwimu zilijumuisha visa na vifo vyote vya malaria vilivyoripotiwa katika Mfumo wa Taarifa za Afya ya Wilaya (DHIS2). Dokezo la kukusanya takwimu likijumuisha taarifa ikiwa ni pamoja na idadi ya visa na vifo vya malaria katika mikoa vilipotokea Watafiti walifundishwa jinsi ya kukusanya takwimu kutoka kwa mfumo wa DHIS2. Ruhusa ya kufanya utafiti huu iliidhinishwa na Wizara ya Afya, Maendeleo ya Jamii, Jinsia, Wazee na Watoto, na Mpango wa Taifa wa Kudhibiti Malaria.

Matokeo: Jumla ya visa 32,363,798 na vifo 20,858 kutokana na malaria vilirekodiwa wakati wa kipindi kinachotolewa taarifa. Visa vipya vya malaria viliripotiwa kwa wingi zaidi mwaka 2015 (visa 163 / katika idadi ya watu 1,000). Idadi ndogo zaidi ya visa vya ugonjwa huu viliripotiwa mwaka 2017 (visa 109 / katika idadi ya watu 1,000). Kiwango cha wastani cha vifo kutokana na malaria katika kipindi cha miaka mitano kilikuwa watu 7 katika idadi ya watu 1,000,000. Mnamo mwaka 2015 kiwango cha wastani cha vifo kilikuwa 11.5 watu kwa kila watu 1,000,000. Mnamo mwaka wa 2019, kiwango cha vifo kilikuwa watu 3.2 kwa kila idadi ya watu 1,000,000. Hii inaonyesha kupungua vifo kwa kiwango cha wastani wa watu 8.3 kwa kila watu 1,000,000. Kupungua huku kitakwimu kulionekana kuwa ni dhahiri kisayansi (p-value, <0.001).

Hitimisho: Kupungua kwa visa vipya vya ugonjwa wa malaria na kiwango cha vifo vilithibitika katika ngazi ya kitaifa kutoka mwaka 2015 hadi 2019 ambapo kadri ya asilimia ishirini ya mikoa ambayo ilikuwa na hali ya matukio ya visa vipya vingi vya ugonjwa wa malaria kubadilika na kuwa katika hali ya matukio ya chini. Kupungua huku kunahusishwa sana na utekelezaji wa afua mbalimbali za udhibiti wa malaria na hatua za kinga ikiwa ni pamoja na vyandarua vilivyotiwa viuatilifu (dawa) vya muda mrefu vya kuua mbu, upulizaji wa viuatilifu ukoko ndani ya nyumba za makazi ya watu, uangamizaji wa viluwiluwi kwa kutumia viuadudu, na uboreshaji wa matibabu sahihi ya wagonjwa kwa wakati kwa kutumia tiba ya dawa mseto aina ya artemisinin ambayo inatibu malaria. Kwa hivyo, Tanzania bila malaria inawezekana endapo dhamira na juhudi za Serikali na wadau ya kufanikisha lengo la kudhibiti hatimaye kutokomeza litafanywa kuwa endelevu.

Maneno Muhimu: Malaria, Mwenendo, Visa, Vifo, Tanzania

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Tanzania on Track to Achieve the End Tuberculosis Strategy 2020 Milestones

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INTRODUCTION

Tanzania is among the World Health Organization's (WHO) top 30 countries with a high tuberculosis (TB) burden. In 2019, Tanzania had an estimated 137,000 cases, which is equal to 237/100,000 population [1]. Tuberculosis is a communicable disease that is a major cause of ill health. It is one of the top 10 causes of death worldwide and is the leading cause of death from a single infectious agent (ranking above HIV/AIDS). It is caused by the bacillus *Mycobacterium tuberculosis*, which is spread when people infected with TB expel bacteria into the air, for example, by coughing. The disease typically affects the lungs (pulmonary TB) but can also affect other organs (extrapulmonary TB). The 30 countries with high TB burden accounts for almost 90% of the global incidence of TB each year [1]. The social and economic impacts are devastating and include poverty, stigma, and discrimination

Tuberculosis is curable and preventable; hence, efforts are directed to finding and treating infected individuals. The Ministry of Health, Community Development, Gender, Elderly and Children (MOHCDGEC), through the National Program for TB and Leprosy, implemented its fifth 5-year plan, the 2015-2020 National TB and Leprosy Strategic Plan (NTLSP), to control TB in Tanzania by 2020. The strategic plan had two goals: from 2015 to 2020, a 20% reduction in the TB incidence rate and a 35% reduction in number TB deaths [2].

The NTLSP was based on WHO's "End TB strategy," to end the global TB epidemic. Its indicators, milestones, and end targets are presented in the table [3].

Table 1: Key global indicators, milestones, and targets for the post-2015 tuberculosis strategy

Indicators with baseline values for 2015	Milestones			Targets
	2020	2025	2030	2035
Percentage reduction in deaths due to tuberculosis (projected 2015 baseline: 1.3 million deaths)	35%	75%	90%	95%
Percentage and absolute reduction in tuberculosis incidence rate (projected 2015 baseline 110/100 000)	20% (<85/100 000)	50% (<55/100 000)	80% (<20/100 000)	90% (<10/100 000)
Percentage of affected families facing catastrophic costs due to tuberculosis (projected 2015 baseline: not yet available)	Zero	Zero	Zero	Zero

Source: WHO, The End TB strategy, table

As the NTLSP was coming to an end, MoHCDGEC, with supervision from WHO, conducted a Joint External Review (JER) in February 2020 to assess the overall performance of the National TB and Leprosy Program (NTLP) and make recommendations for improving performance, investments, and efficiency in the planning and delivery of services. In this paper we report the findings of the JER in the area of case detection.

METHODOLOGY

The JER methods included a desk review of different reports including those from within the NTLP and Ministry, those provided by implementing partners' and WHO global TB report 2020. Similarly, different field teams according to assigned thematic area conducted a number of interviews. The interviewees included Regional and District TB and Leprosy Coordinators, MoHCDGEC staff at headquarter, regional and district level, WHO staff at the country office, Ministry of finance and other partners, while consultative meetings included Regional and Council Health Management Teams, Health Management Committees, patients and community-based organizations, both in the mainland and Zanzibar. Furthermore, field visits included review of records in respective visited health facilities, interview of community members and patients. A mix of international and national experts specializing in programmatic and health care system management including drug-susceptible and drug-resistant TB, infection prevention and control, HIV and leprosy conducted the review. The team also specialized in community development, medical supply chains, monitoring and evaluation, diagnostics, health economics, finance, and human resources for health. The intention was to be inclusive of all sectors and programmatic areas. The JER was carried out at all levels of care: national, regional, and community facilities in the Tanzania mainland and Zanzibar.

RESULTS

Based on the review, it was clearly that the WHO Global TB Report 2020 showed that Tanzania is one of the seven high TB burden countries that have already reached the milestone of 20% reduction in the incidence rate. Other countries that have reached the milestone include Cambodia, Ethiopia, Kenya, Namibia, the Russian Federation and South Africa. The same report also concluded that Tanzania has reached the 2020 milestone

of 35% reduction of TB deaths alongside with Bangladesh, Kenya, Mozambique, Myanmar, the Russian Federation and Sierra Leone.

Through the review, the report shows that the incidence rate declined by 23% from 306/100,000 population in 2015 to 237/100,000 population (Global TB Report 2020) in 2019, TB deaths decreased by 33% from 30,00 to 20,000 (Figure)

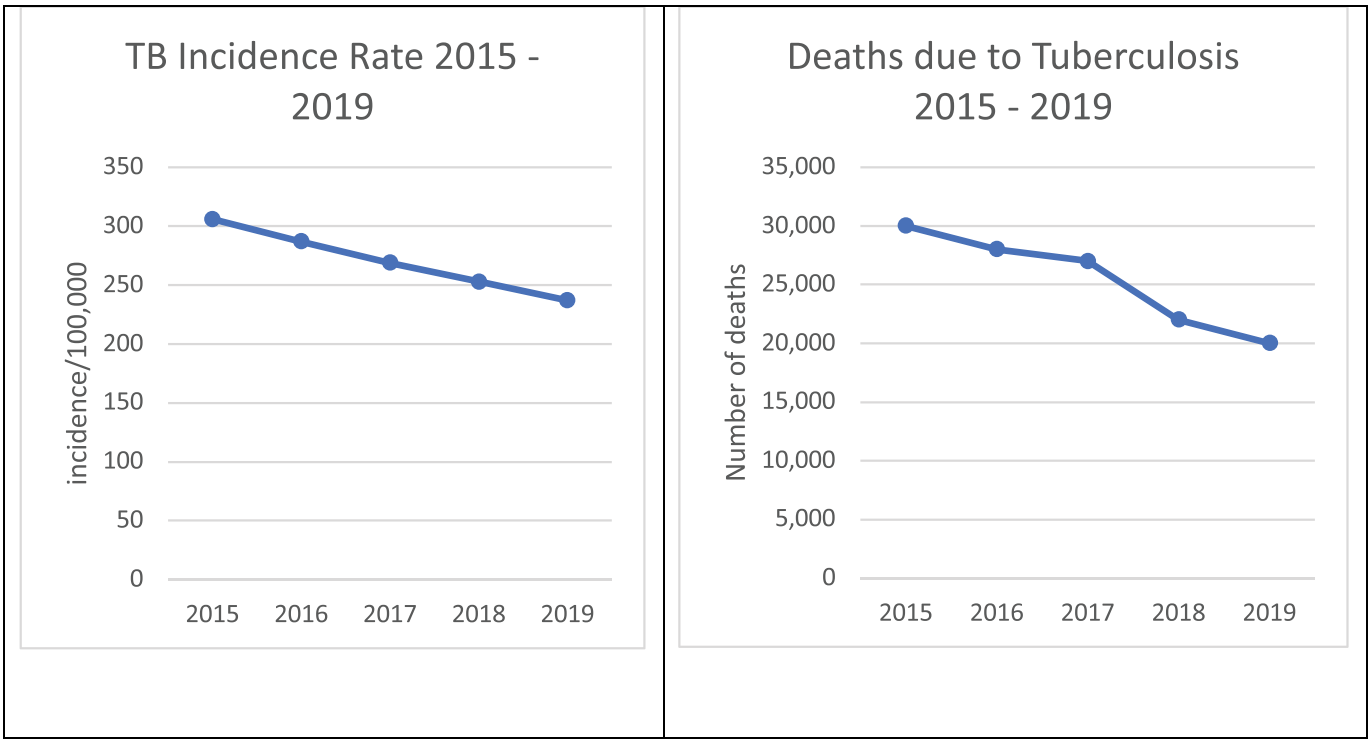

Figure 1: The decline in case incidence rate and death rate due to TB from 2015-2019

These accomplishments are the result of dedicated efforts in TB case detection including innovative approaches to reach vulnerable groups such as miners, children and people living with HIV.

Case detection, diagnoses and treatment

TB notifications (all forms) increased by 32% from 62,180 in 2015 to 82,166 in 2019, effectively reducing the gap between expected and notified cases as a result of;

- A remarkable expansion of the Xpert MTB/RIF Assay [5] within the country, increasing from 66 machines in 2015 to 238 machines in 2019.
- An 80% increase in the number of Tuberculosis Zonal Laboratories between 2017 and 2019.
- Operationalization of electronic web-based and case-based recording and reporting system for TB and leprosy (DHIS2-ETL) which offers recording, tracking and analysis of case-based data and therefore it provides visibility of information at all appropriate levels for effective monitoring, reviews and decision making. All care providers and stakeholders use the system since 2018.
- An increase in the treatment success rate for new drug-susceptible cases from 90% in 2015 to 91% in 2019.

Involvement of other actors

Public-Private Mix (PPM) are increasingly utilized as a public health strategy for strengthening health systems and have become a core component for the delivery of TB control services in most endemic countries. The program utilized this approach by engaging community actors and formal and informal health providers, including faith-based hospitals, for-profit health facilities, quasi-governmental health facilities, traditional healers, congregate settings and Accredited Drug Dispensing Outlets. As a result:

- Ex-patient support groups were mobilized in all regions.
- Community contributions to case finding increased from 19% in 2015 to 26% in 2019.
- The engagement of private health facilities through PPM initiatives resulted iPPM an increase in the contribution of private health facilities to increase the number of patients notified from 11% in 2015 to 19% in 2019.

Advocacy and Social Mobilization

- The TB Parliamentary caucus was launched in 2018.
- The National Stop TB Partnership was established in 2019 and is waiting launching.
- mHealth solutions (Tambua TB meaning realize TB) were implemented to increase community awareness of TB and HIV and to provide a platform for self-screening and real time feedback by TB patients and their affected communities. The self-screening application allows consenting clients to take a self-assessment using the mHealth diagnostic service. If the system classifies client as presumptive, SMS mes-

sages will automatically be sent to client recommending TB testing and providing educational information.

KEY CHALLENGES

Despite improvement in case detection, the program encountered challenges that affected reaching the targets in the NTLSP. These include:

- GeneXpert is very sensitive for the diagnosis of TB cases but is not yet universally available or is underutilized in health facilities.
- There is inadequate equipment maintenance resulting in about 11% of the GeneXpert modules being inoperable at the time of the JER. The inadequate maintenance could be due to a shortage of instrumentation experts.
- Low index of suspicion for TB for People Living with HIV attending Care and Treatment Centres, representing less than 3% positivity yield, instead of estimated 10%.

RECOMMENDATIONS

- Improve GeneXpert utilization and enhance integrated sample referral and transport system and ensure timely results feedback mechanism
- Explore the expansion of access to chest x-rays where needed.
- Adopt more sensitive new diagnostics as per WHO evidence-based recommendations, such as lateral flow urine lipoarabinomannan assay (LF-LAM) [6] to enhance case identification/notification and quality of result.
- Consider adoption of the TrueNAT test for hard-to-reach facilities without stable power supplies [7].
- Plan to conduct a national TB prevalence survey to update measurement of TB burden

ACKNOWLEDGEMENTS

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Disclaimer: Opinions and analyses produced in this report do not reflect the opinion or position of the MOHCDGEC of Tanzania.,

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Tanzania Yafikia Malengo Mkakati ya Mwaka 2020 ya Kutokomeza Ugonjwa wa Kifua Kikuu

Emmanuel Nkiligi[1] Vedastus Kamara[1], Leberate Mleoh[1], Zuweina Kondo[1], and Leonard Subi[2]

UTANGULIZI

Tanzania ni miongoni mwa nchi 30 chini ya Shirika la Afya Duniani (WHO) ambazo ugonjwa wa kifua kikuu (TB) ni tatizo kubwa la kiafya. Mnamo mwaka wa 2019, Tanzania ilikadiriwa kuwa na wagonjwa 137,000, ambayo ni sawa na idadi ya watu 237/100,000 yaani wagonjwa 237 katika kila watu 100,00)[1]. Kifua kikuu ni ugonjwa wa kuambukiza ambao ndiyo chanzo kikuu cha watu kuugua. Kifua kikuu ni moja kati ya magonjwa 10 yanayoongoza kusababisha vifo vingi ulimwenguni pia ndiyo ugonjwa pekee unaosababisha vifo vingi kutokana na maabukizo ya kimelea cha aina moja (hii ni juu zaidi ikilinhanisha VVU/UKIMWI). Ugonjwa wa TB una unasababishwa na vimelea aina ya bacillus Mycobacterium tuberculosis, ambayo huenea wakati watu walioambukizwa na TB wanaposambaza vimelea vya bakteria hewani, kwa mfano, kwa kukohoa. Kwa kawaida ugonjwa huathiri mapafu (TB ya mapafu) lakini pia inaweza kuathiri sehemu nyingine ya mwili (extrapulmonary TB). Nchi 30 zenye tatizo kubuwa la ugonjwa wa TB unachangia karibu asilimia 90 ya visa vipya vya TB kila mwaka [1]. Athari za kijamii na kiuchumi zitokanazo na ugonjwa wa TB ni mbaya, na zinajumuisha umasikini, unyanyapaa, na kutengwa.

Kifua kikuu ni ugonjwa unaotibika na kuzuilika; kwa hivyo, juhudi zimeelekezwa kuwatambua na kuwatibu watu walioambukizwa. Wizara ya Afya, Maendeleo ya Jamii, Jinsia, Wazee na Watoto (MOHCDGEC), kupitia Mpango wa Taifa wa Kifua Kikuu na Ukoma, ulitekeleza mpango wake wa tano wa miaka 5, Mpango Mkakati wa Kitaifa wa Kudhibiti Kifua Kikuu na Ukoma wa mwaka 2015-2020 (NTLSP) nchini Tanzania ifikapo 2020. Mpango mkakati huo ulikuwa na malengo mawili: kutoka mwaka 2015 hadi mwaka 2020, kupunguza kiwango cha matukio ya visa vipya vya TB kwa asilimia 20 na kupunguza idadi ya vifo kwa asilimia 35 [2]

NTLSP ni mpango uliotokana na "mkakati wa kutokomeza TB" wa Shrika la Afya Duniani (WHO), wa kutokomeza janga la TB duniani. Viashiria vyake, hatua muhimu, na malengo yaliyotazamiwa mwisho wa mwaka 2020 yameanishwa kwenye jedwali [3].

Viashiria muhimu vya ulimwengu, hatua muhimu, na malengo ya mkakati wa kifua kikuu baada ya mwaka 2015

Kiwango cha viashiria vya kuanzia kwa mwaka 2015	Hatua Muhimu			Malengo
	2020	2025	2030	2035
Kupunguza asilimia ya vifo vitokanvyo na kifua kikuu (Makadirio ya mwaka 2015 ni vifo million 1.3)	Asilimia 35	Asilimis 75	Asilimia 90	Asilimia 95
Kupunguza kiwango cha maambukizi mapya kifua kikuu (Asilimia, ldadi) (Mkadirio ya mwaka 2015 ni matukio ya visa vipya 110 katika kila watu 100000; 110/100,000)	Asilimia 20 (<85/100000) Chini ya matukio ya visa vipya 85 katika kila watu 100000	Asilimia 50 (<55/100000) Chini ya matukio ya visa vipya 55 katika kila watu 100000	Asilimia 80 (<20/100000) Chini ya matukio ya visa vipya 20 katika kila watu 100000	Asilimia 90 (<10/100000) Chini ya matukio ya visa vipya 10 katika kila watu 100000
Asilimia ya familia zilizoathirika ambazo zinakabiliwa na gharama kubwa kutokana na ugonjwa wa kifua kikuu (Makadirio kwa mwaka 2015: takwimu bado hazijapatikana)	Sufuri	Sufuri	Sufuri	Sufuri

WHO, Mkakati wa Kutokomeza Kifua Kikuu, jedwali

Wakati NTL-SP inakaribia kufikia mwisho, MoHCDGEC, kwa kushirikana na WHO pamoja na watalaam wegine kutoka nje na ndani ilifanya tathmini kwa Pamoja (JER) mnamo Februari 2020. Tathimini ililenga kuona njisi gani Mpango wa Taifa wa Kifua Kikuu na Ukoma (NTLP) ulifikia malengo na kutoa mapendekezo ya kuboresha utendaji, uwekezaji, na ufanisi katika upangaji na utoaji wa huduma. Katika makala hii tunaripoti matokeo ya JER katika eneo la utambuzi na ugunduzi wa wagonjwa wa kifua kikuu.

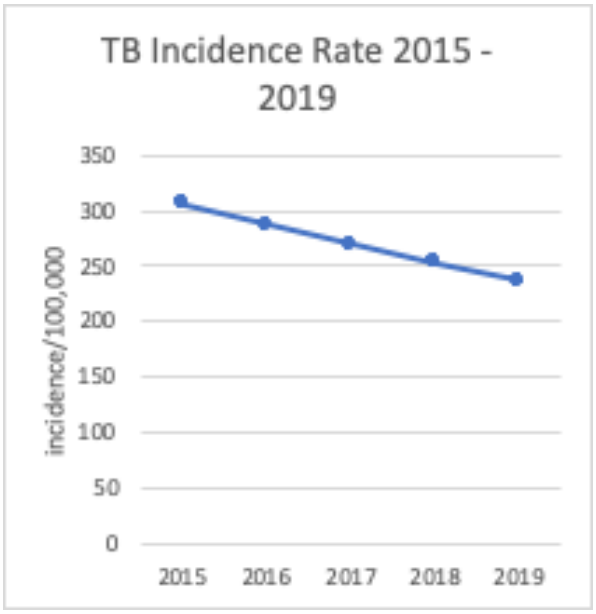
MBINU ZA UKUSANYAJI TAARIFA

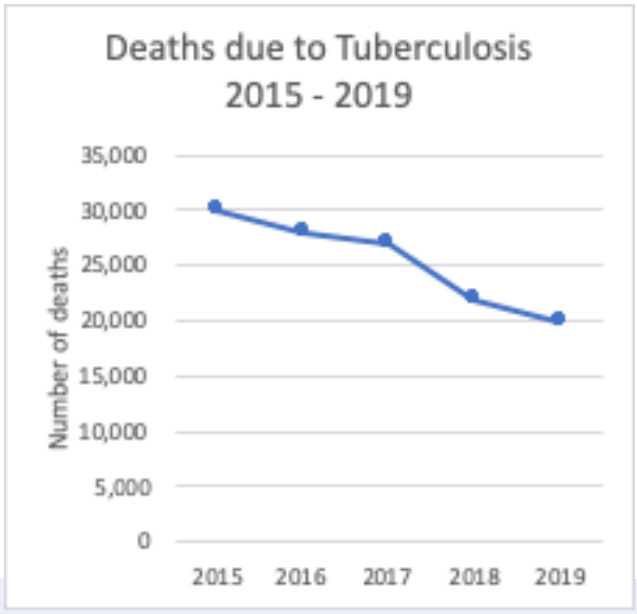
Njia za ukusanyaji taarifa zilizotumiwa wakati wa tathimini (JER) zilijumuisha kupitia taarifa za ripoti mbalimabli pamoja na zile kutoka NTLP na Wizara ya afya, zile za washirika wa maendeleo na ripoti ya TB ya Dunia ya mwaka 2020 ya WHO. Vivyo hivyo, timu tofauti za watafiti walifanya usaili waliyopangiwa kulingana na maeneo yanayohusu mada maalum. Usaili ulifanyika kwa vikundi mbalimabli ukijumuisha Waratibu wa TB na Ukoma wa Mikoa na Wilaya, wafanyikazi wa MoHCDGEC ngazi ya taifa, mikoa na wilaya, wafanyikazi wa WHO katika ofisi ya Tanzania. Usaili pia ulijumuisha Wizara ya fedha na wadau wengine, wakati mikutano ilijumuisha Kamati za Usimamizi wa Afya za Mikoa na Halmashauri, Kamati za Usimamizi wa Afya, wagonjwa na mashirika ya kijamii, Tanzania Bara na Tanzania Kisiwani (Zanzibar). Zaidi ya hapo, watafiti walitembelea sehemu mbalimbali ikijumuisha ukaguzi wa taarifa katika vituo vya kutolea huduma ya afya, kufanya usaili na wanajamii na wagonjwa. Mseto wa wataalam wa kimataifa na kitaifa waliobobea katika usimamizi wa mipango na huduma za kiafya wakiwa na ujuzi wakuchanuwa ugonjwa wa TB sugu ana ile inayotibika. Watafiti hawa pia ni wataalam katika maswala ya kinga ya kuzuia na kudhibiti TB, VVU, na ukoma. Timu hiyo pia ilikuwa na wataalam katika maendeleo ya jamii, minyororo ya usambazaji wa matibabu, ufuatiliaji na tathmini, uchunguzi, uchumi wa afya, fedha, na rasilimali ya watumishi wa afya. Kusudi lilikuwa kujumuisha sekta zote na maeneo yote ya mradi. JER ilifanywa katika ngazi zote za kutolea huduma: Ngazi ya kitaifa, kimikoa, na jamii Tanzania Bara na Zanzibar.

MATOKEO

Kulingana na uhakiki wa taarifa, ilikuwa wazi kuwa Ripoti ya TB ya WHO ya mwaka 2020 ilionyesha kuwa Tanzania ni moja ya nchi saba zenye tatizo kubwa la Kifua Kikuu ambazo tayari zimefikia hatua ya kupunguza kwa asilimia 20 kiwango cha maambauzi mapya ya Kifua Kikuu. Nchi zingine ambazo zimefikia hatua hiyo ni pamoja na Cambodia, Ethiopia, Kenya, Namibia, Shirikisho la Urusi na Afrika Kusini. Ripoti hiyo hiyo pia ilihitimisha kuwa Tanzania imefikia hatua ya 2020 ya kupunguza vifo vitokanavyo na TB kwa asilimia 35, hii ikiwa ni pamoja na nchi za Bangladesh, Kenya, Msumbiji, Myanmar, Shirikisho la Urusi na Sierra Leone.

Kupitia tathimini na uhakiki wa taarifa mbalimbali, ripoti hiyo ya Shirika la Afya Duniani ya mwaka 2020 inaonyesha kuwa kiwango cha matukio ya visa vipya kilipungua kwa asilimia 23 kutoka visa 306 katika kila watu 100,000 (306/100,000) mnamo 2015 hadi visa vipya 237 kati ya watu 100,000 (237/100,000) (Ripoti ya Global TB 2020). Katika mwaka 2019, vifo vitokanavyo na TB vilipungua kwa asilimia 33 kutoka vifo 30,00 hadi vifo 20,000 (Kielelezo).





Kielelezo: Kupungua kwa kiwango cha matukio ya visa vipya na kiwango cha vifo kutokana na ugonjwa wa TB kutoka 2015 hadi 2019

Mafanikio haya ni matokeo ya juhudi za makusudi katika kugundua wagonjwa wa kifua kikuu ikiwa ni pamoja na matumizi ya njia mpya za kufikia makundi ya watu yaliyo katika hatari ya kupata maambukizi kama wachimbaji madini, watoto na watu wanaoishi na Virusi Vya UKIMWI (VVU).

Ugunduzi/ubuaji wa wagonjwa, uchunguzi na matibabu

Utoaji wa taarifa za kifua kikuu (aina zote) ziliongezeka kwa asilimia 32 kutoka visa 62,180 mwaka 2015 hadi visa 82,166 mwaka 2019, ikipunguza vyema pengo kati ya visa vilivyotarajiwa na visa vilivyoripotiwa. Hii inatokana na;

- Upanuzi wa matumizi wa vitendea kazi vya utambuzi (zana) wagonjwa kwa kutumia kipimo aina ya Xpert MTB/RIF Assay [5] ndani ya nchi. Hatua hii ilileta ongezeko la vitendea kazi kutoka mashine 66 mwaka 2015 hadi mashine 238 mwaka 2019
- Ongezeko la asilimia 80 ya idadi wagonjwa wa Kifua Kikuu kutoka maabara za kanda kati ya mwaka 2017 na 2019.
- Matumizi ya mfumo wa kielektroniki wa utunzaji na uchambuzi wa taarifa za wagonjwa wa TB na ukoma (DHIS2-ETL) ambao unatoa nafasi ya kuingiza taarifa, ufuatiliaji na uchambuzi wa takwimu kwa haraka na urahisi kabisa. Hivyo, mfumo huu unatoa uwezekano katika kila ngazi kuwa na uwezo wakuziona hivyo kutoa frusa ya ufuatiliaji mzuri, kuhakiki na kufanya maamuzi. Mfumo huo unatumiwa na watoa huduma na wadau wote tangu 2018.
- Ongezeko la kiwango cha mafanikio ya matibabu ya wagonjwa wapya wa kifua kikuu kutoka asilimia 90 mwaka 2015 hadi asilimia 91 mwaka 2019.

Ushiriki kwa wadau wengine

Ushirikiano kati ya Serikali na Sekta Binafsi (PPM) unazidi kutumiwa kama mkakati wa afya kwa jamii kwa kuimarisha mifumo ya afya na imekuwa sehemu muhimu katika utoaji wa huduma za kudhibiti TB katika nchi nyingi zenye ugonjwa. Mpango huo ulitumia njia hii kwa kushirikisha watendaji wa jamii na watoa huduma ya afya rasmi na wasiyo rasmi, pamoja na hospitali za kidini, vituo vya kutolea huduma ya afya vya binafsi, vituo vya kutolea huduma ya afya vya serikali, waganga wa jadi, na maduka ya dawa muhimu. Matokeo yake:

- Vikundi vya kusaidia vya wagonjwa wa zamani waliopona vilihamasishwa katika mikoa yote.
- Mchango wa wahudumu ngazi ya jamii katika uimbuaji wa wagonjwa wa TB umeongezeka kutoka asilimia 19 mwaka 2015 hadi asilimia 26 mwaka 2019.
- Ushiriki wa vituo vya kutolea huduma za afya vya binafsi kupitia mipango ya PPM ambapo ulisababisha iPPM kuongezeka kwa mchango wa vituo vya kutolea huduma ya afya vya binafsi kwa kuongeza idadi ya wagonjwa waliotolewa taarifa kutoka asilimia 11 mwaka 2015 hadi asilimia 19 mwaka 2019.

Uhamasishaji Jamii

- Kundi la wabunge kwa ajili kuinua mikakati ya kutomeza ugonjwa wa TB lilizinduliwa mnamo 2018.
- Ushirikiano wa Kitaifa wa Kuzuia Kifua Kikuu ulianzishwa mwaka 2019 na unasubiri kuzinduliwa.
- "mHealth (afya mtandao)(Tambua TB = Realize TB) zilitekelezwa kuongeza uelewa wa jamii juu ya Kifua Kikuu na VVU na kutoa jukwaa la kujipima na maoni ya wakati halisi na wagonjwa wa TB na jamii zao zilizoathirika. Maombi ya kujichunguza huruhusu wateja wanaokubali kuchukua tathmini ya kibinafsi wakitumia huduma ya uchunguzi wa mHealth. Ikiwa mfumo kutambatua kama mhisiwa wa kifua kikuu, ujumbe wa maandishi wa simu (SMS) utatumwa moja kwa moja kwa mteja anayependekeza upimaji wa TB na kutoa habari ya kuelemisha.

CHANGAMOTO MUHIMU

Licha ya kuboreshwa kwa hatua ya kugundua visa vya TB, mpango ulipata changamoto ambazo ziliathiri kufikia malengo ya NTLSP. Hii ni pamoja na:

- Licha ya kifaa cha GeneXpert kuwa na unafanisi mzuri wa utambuzi katika uchunguzi wa visa vya TB, lakini bado kifaa hiki hakipatikani sehemu zote au hakitumiki katika kiwango cha juu katika vituo vya kutolea huduma ya afya.
- Kuna utunzaji hafifu wa vifaa vya maabara na hii imesababisha karibu asilimia 11 ya "modules" za GeneXpert kutoweza kufanya kazi wakati wa uhakiki kupitia JER. Kutokuwa na matengenezo madhubuti ya vifaa inawezekana kuwa ni kutokana na upungufu wa wataalam wa ufundi wa kufanya matengenezo hayo.
- Kiwango cha chini cha washukiwa kuwa na ugonjwa wa TB kwa Watu Wanaoishi na VVU wanaohudhuria CTC, vinawakilisha idadi iliyo chini ya asilimia 3 ya wale wanaokuwa na maabukizi, badala ya asilimia 10 amabyo inategemewa.

MAPENDEKEZO

- Kuboresha matumizi ya kipimo aina ya GeneXpert na kuongeza ufanisi katika utumiajai wa mfumo jumuishi wa rufaa na mtandao wa usafirishaji wa sampli ili kuhakikisha utaratibu wa upatikanaji wa majibu ya vipimo kwa wakati unaofaa bila kuchelewa
- Kuangalia uwezekao wa kupanua upatikanaji wa huduma ya eksirei (X-ray) ya kifua pindi pale inapohitajika.
- Kupitisha matumizi ya aina mpya vya vipimo vya uchunguzi kulingana na mapendekezo yanayotokana na ushahidi wa WHO, kama vile utambuzi wa TB kwa njia ya upimaji wa mkojo kutumia "flow urine lipoarabinomannan assay" (LF-LAM) [6] ili kuimarisha utambuzi wa kifua kikuu/utoaji wa taarifa na ubora wa majibu.
- Serikali ifikirie kupitisha matumizi ya kipimo anaina ya TrueNAT katika vituo vya kutolea huduma ya afya ambavyo ni vigumu kufikika na kunatatizo la upatikanaji wa umeme wa uhakika [7].
- Serikali ipange kufanya utafiti wa kitaifa wa TB ili kufahamu umeenekea kiasi gani ili kuhuisha taarifa juu ya ukubwa wa tatizo la ugonjwa wa TB

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Maoni na uchambuzi uliotolewa katika ripoti hii ni jukumu la washauri. Hazionyeshi maoni au msimamo wa MOHCDGEC ya Tanzania au ya usimamizi wa NTLP, au wa maafisa wa MOHCDGEC na wafanyikazi - wataalam wa kitaifa walioorodheshwa katika timu walifanya kama rasilimali watu

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Performance Testing of Bio-digester System for Management of Placenta and Biodegradable Healthcare Waste: A Case Study of Sinza Hospital, Dar es Salaam, Tanzania

*Honest Anicetus[1] and Josephat Saria[2]

ABSTRACT

Introduction: In developing countries, including Tanzania, safe disposal of pathological waste such as placentas in health facilities has been a challenge. In view of establishing beneficial and sustainable disposal mechanisms, we report on the performance of a bio-digester used for the disposal of placentas that generates biogas for use as energy by the hospital.

Methodology: The bio-digester system was implemented at Sinza Hospital in Dar es Salaam City, Tanzania. The hospital is classified as a District Hospital within the structure of the Tanzanian health system. Two bio-digesters were built underground with concrete floors and built up bricks using

a waterproof plaster. The twin digesters of 32m^3 capacity each were connected to a modified toilet in the maternity unit that flushed placentas directly into the digesters. Food waste was added via another inlet to speed digestion.

Results: At a maintained temperature of 28-29 ºC, pH of 6.5-7.5 and pressure of 10 and 12 kPa, production of biogas was recorded 9 and10 days after the initial feeding the bio-digester as an outcome of bacteria decomposing the organic matter. The produced biogas was sufficient to meet the daily hospital energy demands for cooking and boiling water for bathing and laundry. In order to maintain if efficience, the bio-digester is cleaned by extracting or fetching out the heavy sediment (sludge) that settles at the botom of the tank every 5-8 years depending on the use. This is done for the purpose of providing enough room as accumulation of sludge reduces space in the tank.

Conclusion: The bio-digester is appropriate technology to treat healthcare waste, which is otherwise difficult to dispose and that the quantity of the biogas generated was enough to support the hospital's energy demands for cooking and for heating water for bathing and laundry.

Key words: Bio-digester, healthcare waste, biogas, appropriate technology

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INTRODUCTION

In Tanzania, as many parts of sub-Saharan Africa countries, there is no suitable disposal route for pathological waste. Most hospital managers pay contractors to remove the waste from the hospital complex unaware of the potential hazards of mismanaged healthcare waste.

Healthcare waste generation depends on numerous factors (Figure 1), including types of healthcare facilities (HCF), hospital specialization, available waste segregation mechanisms, seasonal variation, number of hospital beds, and out patients treated on a daily basis [1]. In developing countries there is a serious lack of reliable information on factors such as waste generation and waste characteristics, making it very difficult to identify appropriate and sustainable management solutions [2].

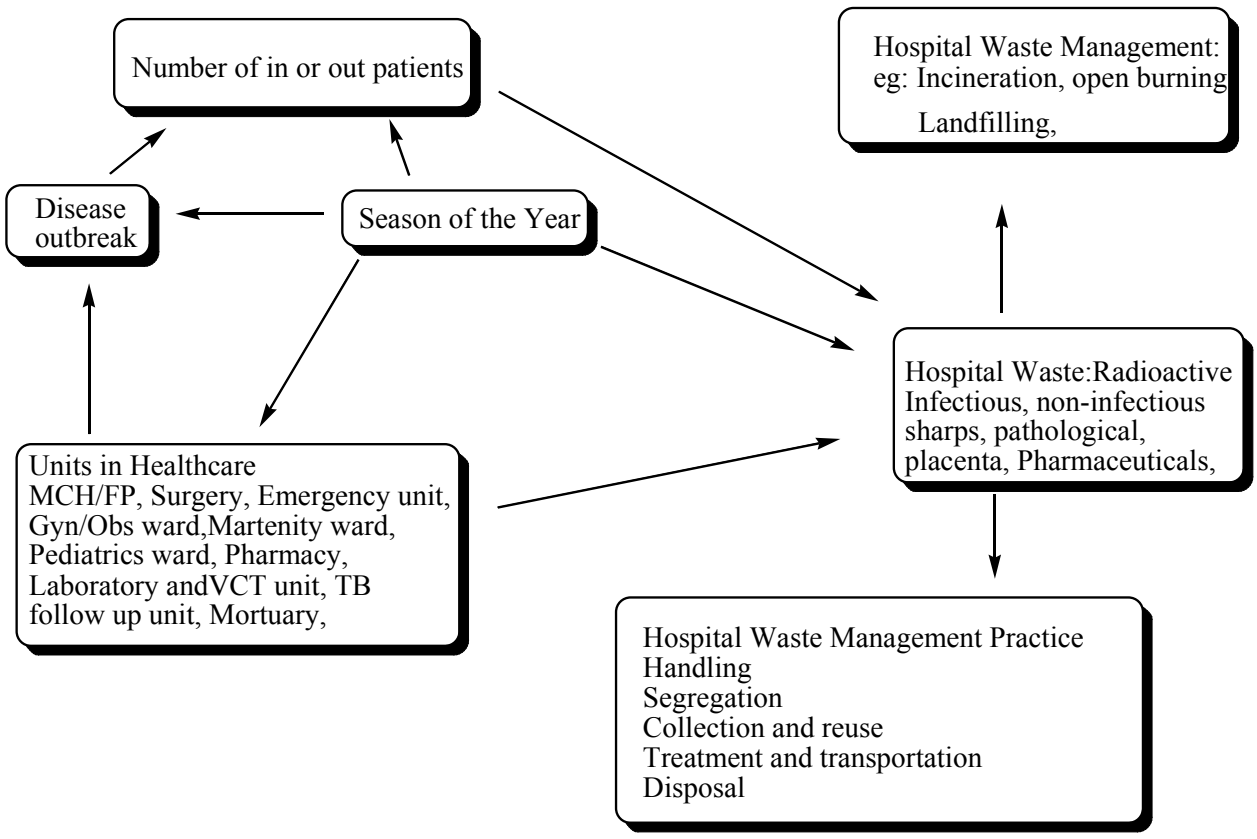

Fig 1: Factors that determine healthcare waste generation rate in healthcare facilities

Healthcare waste (HCW) is a by-product of healthcare that includes sharps, blood-contaminated materials, body parts (including placentas), expired pharmaceuticals, medical devices and radioactive materials [3]. When HCW gets disposed off in areas near groundwater sources used for drinking, the whole water body can become chemically or microbiologically polluted [4]. Direct dumping of such untreated hazardous waste

in riverbanks or other landfill sites can lead into accumulation of toxic substances in the soil causing soil pollution [5]. Dumping can also damage aquatic life and spread water-borne infections like cholera, typhoid, and hepatitis A and C. Similarly, the emission of methane, a greenhouse gas from the solid waste landfill causes air pollution.

A number of (opportunistic) pathogenic bacteria, including *Pseudomonas* spp., *Lactobacillus* spp., *S*taphylococcus spp., *Micrococcus* spp., *Kocuria* spp., *Brevibacillus* spp., *Microbacterium oxydans,* and *Propionibacterium acnes*, were identified and reported from various medical wastes [6]. In addition, pathogenic viruses such as noroviruses and hepatitis B virus have been detected in human tissue wastes [7]. Commonly identified bacterial and viral pathogens such as *Pseudomonas* spp., *Corynebacterium diphtheriae, Escherichia coli, Staphylococcus* spp., and respiratory syncytial virus (RSV) have been reported to be part of medical wastes (Table).

Table: Microbial diseases associated with health care waste*

Microbial Group	Type of Disease Caused
Bacterial	Tetanus, gas gangrene and other wound infections, anthrax, cholera, other diarrhoeal diseases, enteric fever, shigellosis, plague etc
Viral	Various hepatitis, poliomyelitis, HIV infections, HBV, TB, STD rabies etc
Parasitic	Amoebiasis, giardiasis, ascariasis, ancylomastomiasis, taeniasis, echinococcosis, malaria, leishmaniasis, filariasis etc
Fungal infections	Various fungal infections like candidiasis, cryptococcosis, coccidioidomycosis etc

** Table adapted from Akter et al., 2010 [8]*

One of the key problems facing most hospitals in Tanzania is disposal of human anatomical waste (including placentas). Incineration is the only high technology used in disposing of most medical waste. However, this is not practical because about 80 percent of the waste is water so simple heating to turn waste into ash requires too much fuel to be feasible. Using autoclave treatment is technically feasible, but contradicts ethical, legal, cultural, religious and other considerations; hence it is not usually used. Aanaerobic digestion has the potential to solve both aforesaid problems in health care setting. In addition this approach will provide clean fuel as biogas and slurry that can be used in agriculture as compost fertilizer. The first performance test of a bio-digester was conducted at Mwananyamala Referral Hospital [9]. The present paper report the findings of a study aimed at scaling up and piloting the bio-digester system as an alternative for the management of biodegradable healthcare waste. The study focused on safe treatment of pathological waste and energy production analyzing the relation between temperature and pH of the digestion system.

MATERIALS AND METHODOLOGY

Sample Site

The study was conducted at Sinza Hospital in Dar es Salaam City in Tanzania. The hospital is classified as a District Hospital within the structure of the Tanzanian health system. It is designed to offer inpatient and outpatient services to a large volume of people from diverse social backgrounds. Women's health, labor and delivery, counseling, administration, minor and major operating theatres are popular settings for practicums.

Design of Bio-digester and Addition of Placenta and Food Waste

The two bio-digesters, each with a capacity of 32 cubic meters, were built underground with a concrete floor (Figure 2). The bio-digester walls were constructed using concrete paver blocks with the strength of 35Mpa and plaster using a cement-sand ratio of 1:3. A modified toilet in the maternity unit flushed placentas directly into the digester. Food waste was added via another inlet located outside the hospital building. The flow-through system is gravity driven and therefore, requires no power; hence the digested material flows into the sewer/septic tank without further handling. Designs of bio-digester are site specific, based on the amount of waste, available space, and locations of input sources and the sewer/septic tank.

Figure 2: The Design of Bio-digester

The radius of the two dome bio-digesters is 2.5 meters each. They are spherical in shape with conical bottoms. The bio-digester design includes two inlets: one for placenta, which was connected to the bio-digester with a 6-inch pipe, and the other for discharging soft organic materials. The outlet is cylindrical in shape, and it discharges the slurry from the bio-digester to the displacement channel. The produced biogas that accumulates in the upper, inside part of the bio digester is collected through Iron Pipe Size (IPS) pipes attached to the twin burners – cook stoves located in the maternity ward. In line with the piping system there is water trap for collection of condensation water in the system.

The placentas were measured in a stainless-steel bucket, and then disposed of in the toilet. The weight of the bucket was deducted from the total weight. For flushing, we add another 10 liters to the hydraulic retention time. To dispose the placentas, the toilet was installed with a larger sewer pipe (15.3 cm). With one flush, the toilet was completely emptied, and the placentas were transferred to the bio-digester. As fresh placentas are heavier than water, they sink to the bottom of the bio-digester and cannot float up into the pipe. Even later, when gas production within the placentas causes them to become lighter, they cannot escape the bio-digester through the inlet pipe.

Ethical considerations

Ethical clearance and permission for data collection was obtained from Ministry of Health, Community Development, Gender, Elderly and Children (MoHCDGEC). Written consent was obtained from Ubungo Municipal administrative and health authorities and from Sinza Hospital Management.

RESULTS AND DISCUSSION

Healthcare Waste

The total average daily generation rate of HCW, infectious, pathogenic, non-infectious and sharps, was 216.4 kg/d (Figure 3).

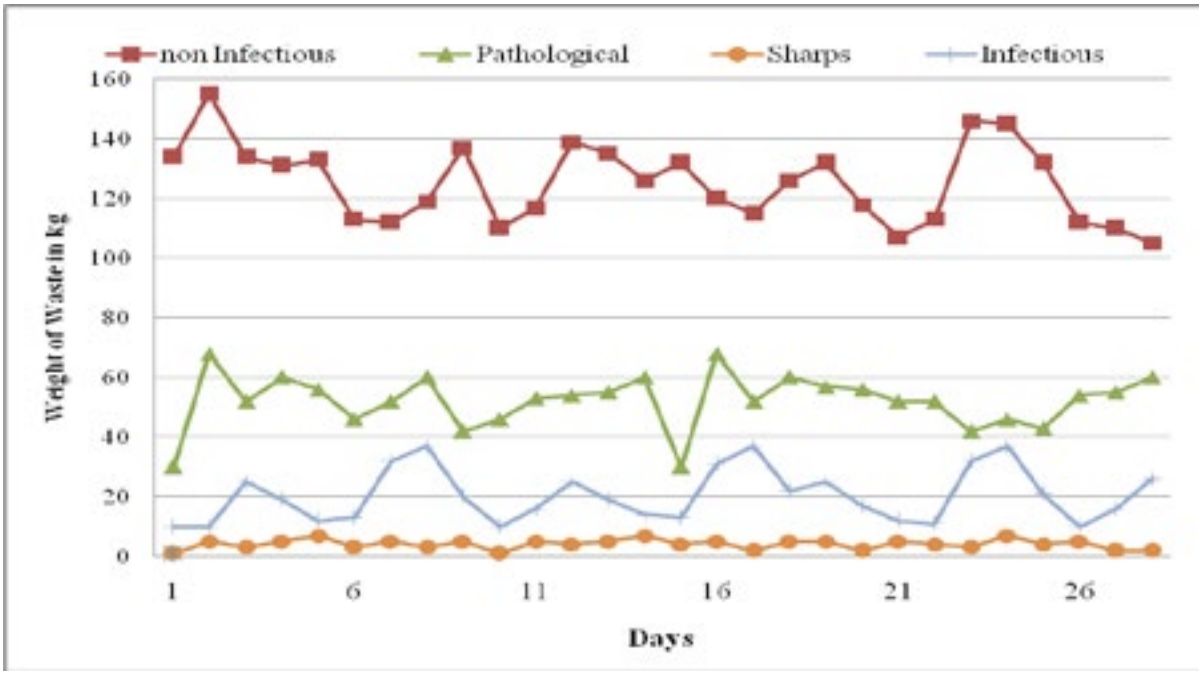

Figure 3: Volume of Healthcare waste kg/day

It was difficult to determine patients per day as sometimes the number exceeded beds. Therefore, the discussions with the medical and paramedical staff (nurses, nursing-assistants and technical services) enabled to adjust the total volume of waste collected by using a physical measurement for each category of waste collected through color-coded container. At present Sinza hospital has 80 beds, inpatient is 203 and out patient department (OPD) is 2,000 per day. According URT/WB [12], in Tanzania hospitals and dispensaries, around 0.03 kg/patient/day of HCW are generated. Therefore, by using OPD value we can estimate the HCW per bed per day which is; 2.000 people x 0.03kg/patient/day = 60 kg/day. Therefore since the total average HCW at Sinza hospital is 216.4 kg/d. Then the average total waste per bed is the total waste minus OPD total waste which is (216.4 – 60) kg/day = 156.4 kg/d. Therefore, we can estimate the value per bed 156.4 kg/day /80 beds = 1.96 kg/day/bed. These values resemble the results reported in Middle East, Latin America and India which ranged between 1.0 - 3.0 kg/day [10], but higher that the value determined earlier in Tanzania ranges between 0.3 - 1.8 kg/day established by Mato and Kassenga [11].

The average daily generation of non-infectious waste was 121.5± 9.9 kg/d, which is equivalent to 56.1 % of all waste generated. The average daily generation of sharps waste in Sinza hospital was 4.9 ± 2.2 kg/d making 2.3% of all waste generated per day. This value is about ½ of the values detected earlier [13] at Muhimbili referral National hospital 8.5 ± 2.7 kg/day). For the pathological waster the daily generation rate was 41.3±9.2 kg/day making 18.8% of all waste generated in hospital. For the infectious waste the daily generation rate is 48.6 ±9.2 kg/day equivalent to 22.5% of the entire waste generated. The value detected earlier [13] at Muhimbili National hospital (537.8 ±21.2 kg/day) is 11 times higher than the value of our study, but those at Mwananyamala hospital (84.1 ± 29.0 kg/day) were 1.7 times higher than values from our study.

Amount of Waste in Kilograms Added to the Bio-digester

An average of 24.2 ± 4.3 kg/day of placenta and 27.4 ± 2.1 kg/day of food waste was fed to the digester (Figure 4). Food waste is almost 1.2 times higher than the placenta for more efficient gas production. This is higher than the amount of cow dung used elsewhere [14] where 13.5 kg of cow dung was used.

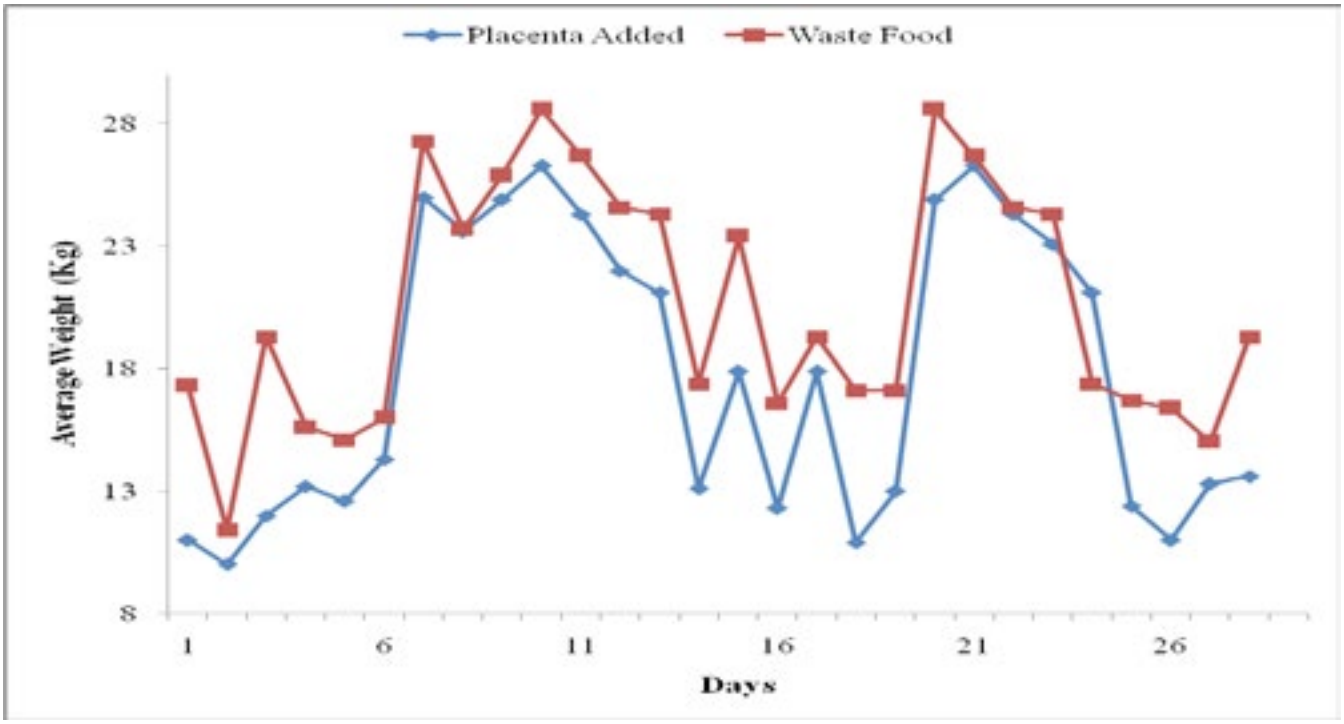

Figure 4: Amount of Placenta and Waste Food Added to Bio-digester

The experiment has been closely monitored and changes in water level, due to the production of gas, have been noted. A sudden increase in methane gas production was noted due to the activity of the bacteria on organic matter 9 - 10 days after feeding the bio-digester compared with 18 days detected earlier [14].

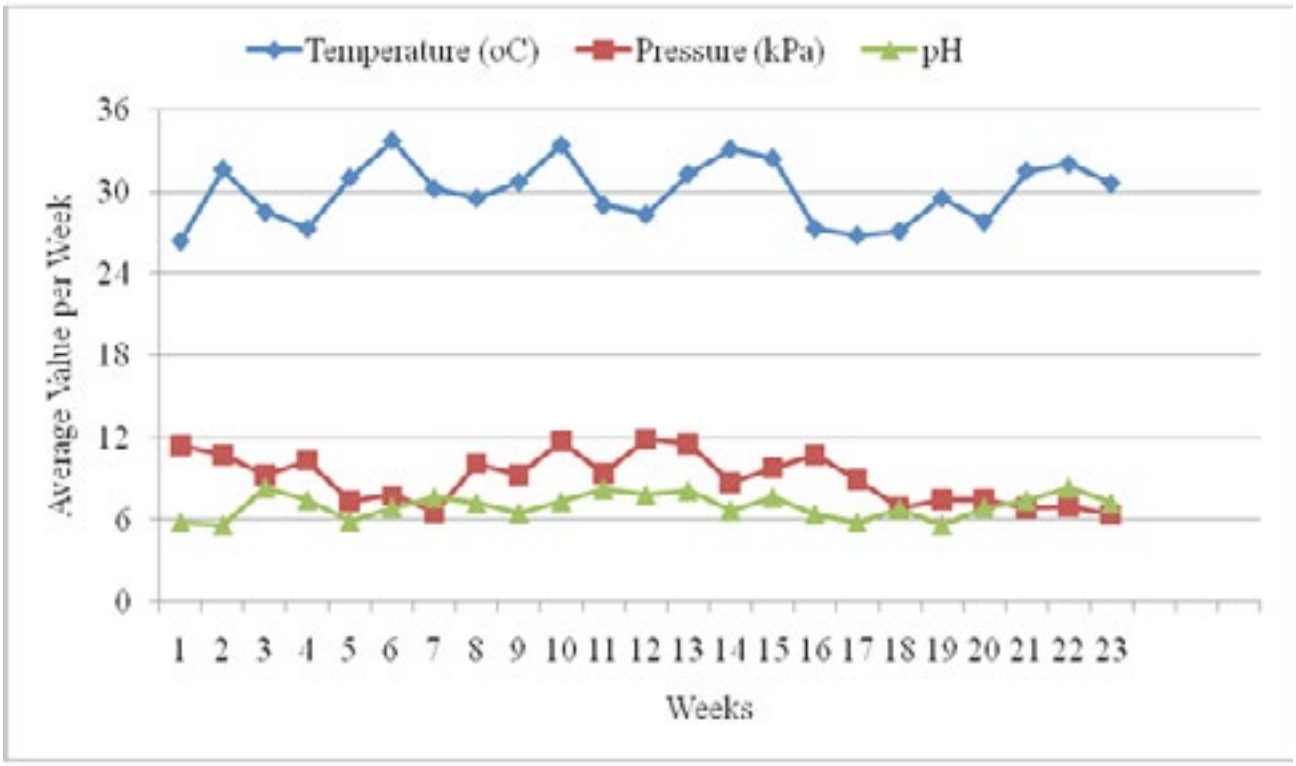

Figure 5: pH and Temperature Levels

Figure 5 provided the recommended temperature, pH and pressure that allowed growth and production of gas through the bio-digester. The pH and Temperature levels were monitored for a couple of weeks. The temperature ranged from 25°C to 35°C, which was noted to be favorable for the growth of methoangenic bacteria. It was noted that when temperature exceed 45°C, the growth of bacteria was hindered which may cause reduction in methane. Again the pH has been maintained between 6.5 and 7, which again was favorable range for methoanogenic bacteria growth. The pressure was maintained between 10 and 12 kPa. Under these conditions of temperature, pH and pressure the volume of gas generated in a day was high enough to meet the needs of the hospital.

Bio-digester Maintainance

In relation to maintain its efficiency, the bio-digester is cleaned by extracting or fetching out the heavy sediment (sludge) that settles at the botom of the tank every 5-8 years depending on the use. This is done for the purpose of providing enough room as accumulation of sludge reduces space in the tank.

CONCLUSION

Bio-digesters have proved to be efficient for the safe disposal of pathological waste and have the added advantage of generating biogas as a source of energy for hospital use. This is the best environmentally friendly technology for the management of pathological waste. Hospitals in Tanzania should be encouraged to use this technology to treat pathological waste and also for energy generation (biogas).

ACKNOWLEDGMENTS

We wish to acknowledge the Ministry of Health, Community Development, Gender, Elderly and Children and Ubungo Municipality who permitted researchers to construct the digester at Sinza Hospital premises and do the designed activity. Our heart appreciation goes to Sinza Hospital Management and all staff for their support, cooperation, help and hospitality during fieldwork.

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MUHTASARI

Upimaji wa Utendakazi wa Mfumo wa kumeng'enya Kondo la Nyuma na Taka Zingine Zitokanazo na Huduma za Afya Zinazoweza kumeng'enywa kwa kutumia Mfumo au Tekinologia ya Kibailogia wa kumeng'enya Taka (Bio-digester): Makala ya Uchunguzi Kutoka Hospitali ya Sinza, Dar es Salaam, Tanzania

*Honest Anicetus[1] and Josephat Saria[2]
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Utangulizi: Katika nchi zinazoendelea, ikiwa ni pamoja na Tanzania, uhifadhi salama wa taka zitokanazo na sehemu ya mwili wa binadamu kama vile kondo la nyuma baada ya mama kujifungua katika vituo vya kutolea huduma ya afya imekuwa changamoto. Hivyo, katika mtazamo wa kuanzisha mifumo ya utupaji wenye manufaa na endelevu, tunaripoti juu ya ufanisi wa utendaji wa mfumo - tekinologia wa kibiologia wa kumeng'enya unavyotumika kwa uhifadhi salama wa kondo la nyuma pamoja na mabaki ya vyakula toka kwa wagonjwa ambao utaweza kuzalisha bayogesi ya kutumika kama nishati mbadala katika hospitali.

Mbinu: Mfumo wa mtambo wa kumeng'enya taka za kibailojia ulitekelezwa katika Hospitali ya Sinza katika Jiji la Dar es Salaam, Tanzania. Hospitali hiyo imeainishwa kama hospitali ya wilaya ndani ya muundo wa mfumo wa afya wa Tanzania. Mitambo miwili ya umeng'enyaji taka za kibiolojia ilijengwa chini ya ardhi ambapo matangi yake sakafu ilijengwa kwa zege na kuta zilijengwa kwa matofali ya saruji na kusakafiwa (kufanyiwa plasta) isiyoweza kupenyeka na maji. Mitambo hii pacha yenye uwezo wa ujazo wa $32m^3$ kila moja viliunganishwa na choo cha kisasa kwenye kitengo cha uzazi ambacho kinaruhusu kusukuma kondo la nyumba lililotubukizwa moja kwa moja kwenda kwenye mfumo wa umeng'enyaji. Taka za chakula ziliongezwa kupitia tundu jingine ili kuharakisha mchakato wa umeng'enyaji.

Matokeo: Katika joto linalodumishwa, pH na mgandamizo, uzalishaji wa bayogesi ulianzakuonekana siku 9 na10 baada ya kuanza kuweka taka za kibiolojia kwenye mtambao wa kumeng'enya. Uzalisaji wa bayogesi ni matokeo ya bakteria kumeng'enya kwa kuvunjavunja ghafi. Bayogesi iliyozalishwa ilitosha kukidhi mahitaji ya kila siku ya nishati ya hospitali kwa kupikia na kuchemsha maji ya kuoga na kufulia. Ili kuhakikisha ufanisi wa mtambo huu husafishwa kwa kuchota tope (sludge) lililokaa chini kila baada ya miaka 5-8 kutegemeana na matumizi. Lengo la kutoa tope zito ni kupata nafasi kupokea taka zingine kwa ajili ya kumeng'enywa kwan likiendelea kuwepo kwenye tangi hupunguza nafasi.

Hitimisho: Mtambo wa kumeng'enya taka za kibiologia ni teknolojia inayofaa kutumika katika uhifahadhi salama taka zinazotokana na huduma za afya, ambayo ni vigumu kuzihifadhika salama kama vile kondo la nyuma kwa vile huanza kutoa harufu mda mfupi baada ya mzazi kujifungua. Aidha uwingi wa bayogesi inayozalishwa ilitosha kukidhi mahitaji ya nishati ya hospitali kwa kupikia na kuchemshia maji ya kuoga na kufulia.

Maneno muhimu: Mtambo wa kumeng'enya taka za kibiologia, taka zitokanazo na huduma za afya, bayogesi, teknolojia inayofaa

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Brucellosis Diagnosis: Performance, Reporting and Costs of Frontline Tests

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KEY MESSAGE

- Many rural healthcare facilities lack diagnostic and reporting tools for brucellosis.
- The Rose Bengal Test (RBT) has an accuracy level of 95-98% and is inexpensive when considered as a test for brucellosis diagnosis in health facilities.
- The locally available rapid, commercial, serological tests showed poor performance and higher cost than the RBT as frontline tests
- Training on the use of RBT for brucellosis in health facilities can improve routine diagnosis of brucellosis.
- A large scale, robust evaluation of the RBT for brucellosis in suspected patients could provide critical information on the feasibility of a national control program and how to scale it up countrywide.

BACKGROUND AND PROBLEM STATEMENT

The Tanzania One Health policy for the control and elimination of zoonoses list brucellosis as the sixth priority disease [1]. Brucellosis is among the most common bacterial zoonoses globally affecting wild animals, livestock and humans caused by bacteria of the genus ***Brucella***. The bacteria can spread from animals to humans. People can contract the disease by consuming unpasteurized dairy products from animals that are infected with the bacteria such as cows and goats. Previous studies have shown that up to 500,000 new cases occur globally each year and in northern Tanzania, up to 7% of patients presenting to health facilities suffer from illness due to brucellosis [1,2]. It affects mostly pastoral communities and is widespread in many low-income countries [1,2].

Brucellosis is poorly diagnosed due lack of appropriate diagnostics and limited awareness among medical practitioners [1], however its symptoms may include joint and muscle pain, fever, weight loss and fatigue. Some people rarely develop stomach pain and cough. Brucellosis is difficult to treat, but is managed with antibiotics. The recommended antibiotic is doxycycline in combination with rifampicin or gentamycin for 6-8 weeks [3], in Tanzania doxycycline in combination with gentamycin are commonly used while rifampicin is reserved for Tuberculosis treatment. The national surveillance guidelines for brucellosis in Tanzania recommend that all patients presenting to health facilities with brucellosis-consistent symptoms should be tested with RBT, followed by a confirmatory serological test [2,3]

In most primary healthcare facilities a range of locally available, commercial tests, with reported poor performance, are used [5,8]. Slow and tedious, paper-based reporting systems often cause delays in reporting of the disease [6,7]. Low community awareness about brucellosis has also led to increased transmission and impacts of brucellosis [4,6]. The cost of brucellosis misdiagnosis is an important element of the total public and private impacts of the disease. Misdiagnosed brucellosis is costly, including reduced income due to prolonged illnesses, prescriptions of inappropriate drugs, and repeat visits to health facilities, many of which end in misdiagnosis of illness due to inaccurate tests [5,8].

The running costs of currently available test options in northern Tanzania have not been previously evaluated [5]. Although some studies have previously assessed diagnosis of human brucellosis in Tanzania, very few studies have focused on the reporting of the disease [6,7]. A comprehensive evaluation of test performance and costs of the current test options would advise the improvement of brucellosis diagnosis in the East and Central Africa region. This stage is essential to mitigate some of the impacts of the disease. The assessment of frontline health workers awareness of brucellosis and provision of electronic-based technology for reporting brucellosis cases could improve of brucellosis diagnosis and reporting in Tanzania and mitigate some of the impacts of the brucellosis.

POLICY OPTIONS

- Knowledge on brucellosis diagnosis among healthcare workers is crucial to the mitigation of disease impacts. Awareness sessions and trainings were conducted among frontline health workers (Figure 1). After training, trainees were able to use RBT for diagnosis of brucellosis. RBT is simple and easy to use by health workers with limited laboratory

technology. Therefore, a coordinated approach to brucellosis testing in health facilities is feasible as part of a disease control strategy.

» The RBT is an inexpensive and accurate and therefor appropriate for system-wide use in health facilities. As presented in Figure 2, an RBT test (0.7 USD) costs almost USD 2.00 less than a cELISA test (2.5 USD), half the cost of the commercial rapid tests (1.1 USD) and, with an accuracy of 95-98%; it outperforms other tests on the market.

» Consideration of faster, electronic-based reporting systems to improve surveillance of brucellosis e.g. AfyaData mobile reporting tool [6].

Fig 1: Training of frontline healthcare workers on the use of the RBT for brucellosis testing in Kilosa district, Morogoro. (Photo courtesy of Mligo Belinda)

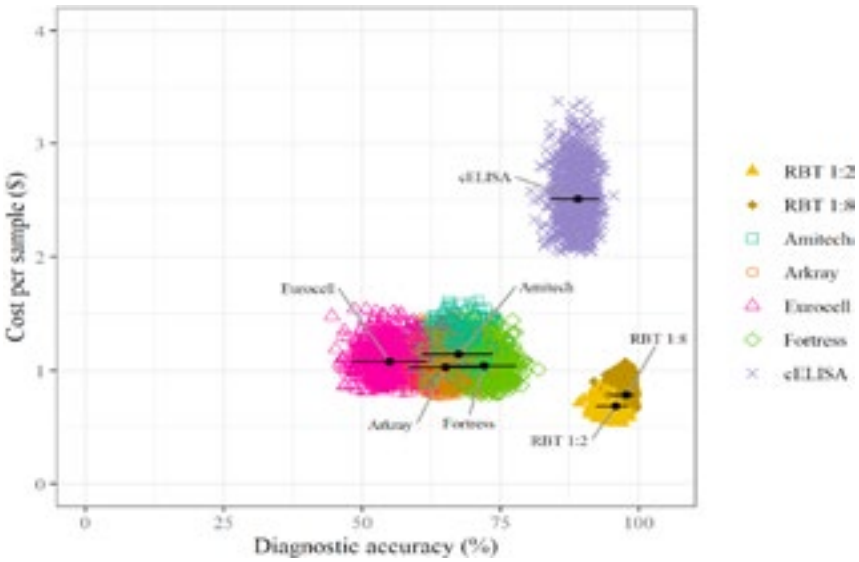

Fig 2: Cost per sample of each of tests vs diagnostic accuracy in testing for brucellosis. *RBT - Rose Bengal test, cELISA - competitive enzyme-linked immunosorbent assay [image credits- Lukambagire *et al.*, Sci Rep11, 5480 (2021)].

CONCLUSIONS AND RECOMMENDATIONS

The RBT is accurate, inexpensive, simple to use, and can be implemented as a frontline test in health facilities in diagnosis of brucellosis. Other control activities include training seminars for frontline health workers to raise their awareness on brucellosis, and improved laboratory diagnosis and surveillance of brucellosis cases in people and animals to enhance Tanzania's capacity to manage and control the disease. Ultimately, a system-wide, coordinated application of the RBT and an appropriate confirmatory test is needed that would significantly improve current data on human brucellosis, facilitating ongoing control strategies.

NOTE: The cover photographs show; 1. A local livestock and produce market in Ngorongoro district. Livestock keeping is an important economic activity for many Tanzanians, with cattle, sheep and goats playing a central role in brucellosis transmission to people. 2. Serology test kit for brucellosis used in a health facility in Arusha region, northern Tanzania. Previous studies have shown many of test kits currently used are less accurate and cost more than the recommended RBT (Photos courtesy of L.A.S and Jo Halliday).

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Uchunguzi wa Ugonjwa wa Brusela: Sifa Za Utendaji, Utoaji Taarifa na Gharama ya Vipimo Maalum

Lukambagire AS[1,2], Mligo JB1, Mwakapeje E[3], Mathew C[1], Shirima G4, Karimuribo ED[1], Kazwala R[1], Mmbaga BT[2,5]

UJUMBE MAALUM

- Vituo vingi vya huduma za afya vijijini havina vitendea kazi kwa ajili ya uchunguzi na utoaji taarifa za ugonjwa wa brusella.
- Kipimo cha Rose Bengal Test (RBT) kina kiwango cha usahihi wa ugonjwa wa brusela wa kiasi cha asilimia 95 hadi 98 na ni cha gharama nafuu hivyo kinafaa kuzingatiwa kama kipimo cha uchunguzi wa ugonjwa wa brusela katika vituo vya kutolea huduma ya afya.
- Vipimo ya uchunguzi wa haraka vilivyopo na kutumika nchini vimethibitika kuwa duni katika uchunguzi wa utambuzi wa ugonjwa wa brusela na gharama yake ni kubwa kuliko kipimo maalum cha RBT kwa minajili ya kutumika kama vipimo vya uchunguzi katika vituo vya kutolea huduma ya afya.
- Mafunzo juu ya matumizi ya kipimo maalum cha RBT juu ya brusela katika vituo vya kutolea huduma ya afya yanaweza kuboresha utambuzi wa ugonjwa wa brusela.
- Tathimini ya kiwango kikubwa na thabiti juu ya kipimo maalum cha RBT kwa wagonjwa wanaoshukiwa kuwa na ugonjwa wa brusela inaweza kutoa taarifa muhimu juu ya taswira ya mpango wa kitaifa wa kudhibiti ugonjwa wa brusela na jinsi ya kuupanua nchi nzima.

UTANGULIZI NA CHIMBUKO LA TATIZO

Sera ya Afya Moja ya Tanzania ya kudhibiti na kutokomeza magonjwa yanayoenezwa na wanyama imeorodhesha ugonjwa kati ya magonjwa sita yanayopewa kipaumbele[1]. Brusela ni moja ya magonjwa yanayosabishwa na vimelea aina ya bakteria unaoenezewa kwa kasi mno duniani ambapo unaathiri wanyama pori, mifugo na wanadamu. Ugonjwa huu uambukizwa na bakteria wa jamii ya Brucella. Bakteria inaweza kuenea kutoka kwa wanyama kwenda kwa wanadamu. Watu wanaweza kuambukizwa ugonjwa kwa kutumia chakula kilichotengenezwa na maziwa ambayo hayajachemushwa kutoka kwa wanyama ambao wameambukizwa na bakteria kama ng'ombe na mbuzi. Taarifa za tafiti za hapo awali zimeonyesha kuwa hadi visa vipya 500,000 vinatokea ulimwenguni kila mwaka, na upande wa kaskazini mwa Tanzania, hadi asilimia 7 ya wagonjwa wanaohudhuria vituo vya vya kutolea huduma ya afya wanaugua na brusela [1,2]. Ugonjwa huu huathiri zaidi jamii za wafugaji na umeenea zaidi katika nchi za kipato cha chini [1,2].

Ugonjwa wa brusela haugunduliki kirahisi kwa sababu ya ukosefu wa vifaa sahihi vya uchunguzi na uelewa mdogo kati ya watoa huduma ya afya[1], hata hivyo dalili zake zinaweza kujumuisha maumivu ya viungo na misuli, homa, kupungua uzito na uchovu. Watu wengine hupata maumivu ya tumbo na kikohozi kwa nadra. Ugonjwa wa brusela ni vingumu kutibika, lakini unatibika na dawa aina ya antibiotikisi. Dawa ya antibiotikisi inayopendekezwa ni aina "doxycycline" ikitumika pamoja na "rifampicin" au "gentamycin" kwa wiki 6-8 [3]. Hata hivyo kwa Tanzania "doxycycline" inatumika pamoja na "gentamycin" wakati "rifampicin" ikitengwa mahususi kwa ajili ya matibabu ya kifua kikuu. Mwongozo wa kitaifa ya ufuatiliaji wa ugonjwa wa brusela nchini Tanzania unapendekeza kwamba wagonjwa wote wanaohudhuria vituo vya kutolea huduma ya afya na dalili zinazofanana na za brusela wanapaswa kupimwa na kipimo maalum cha RBT, ikifuatiwa na kipimo kingine kuthibitisha matokeo ya awali [2,3]. Vituo vya kutolea huduma ya afya vingi vya vijijini havina uwezo wa kutibu vyema wagonjwa wa brusela [5,8].

Katika vituo vingi vya huduma ya afya ya msingi, vipimo vinavyopatikana katika soko la kibiashara vinatumika kupimia wagonjwa wa brusela ambavyo utendaji wake unaripotiwa kuwa uko chini [5,8]. Mifumo ya kutumia karatasi kutolea taarifa ni ya polepole sana, hivyo inasababisha ucheleweshaji wa upatikanaji wa taarifa za ugonjwa [6,7]. Uelewa mdogo wa jamii kuhusu ugonjwa wa brusela pia umesababisha kuongezeka kwa maambukizi na athari za brusela [4,6]. Madhara ya utambuzi usiosahihi wa ugonjwa wa brusela ni jambo muhimu na kutilia maanani kutoka na athari za ugonjwa huo kwa jamii. Ugonjwa wa brusela ukikosewa kugunduliwa sahihi unasababisha gharama kubwa. Gharama hizi ikiwa ni pamoja na madhara ya kupunguka kwa kipato kutokana na kuugua kwa muda mrefu, kusababisha kutumia dawa zisizosahihi

hivyo kutotibika. Aidha unasababisha mgonjwa kurudi mara kwa mara kwenye vituo vya kutolea huduma ya afya kufuatilia matibabu, ambapo hata hivyo huishia kupata matokeo ya ugonjwa yasiyosahihi kwa sababu ya kutumika vipimo visivyo na ubora sahihi [5,8].

Gharama za uendeshaji wa vipimo vinavyotumika kwa sasa katika eneo la kaskazini mwa Tanzania hajawahi kutathminiwa [5]. Ijapokuwa kumekuepo na tafiti zingine hapo awali zilizotathmini utambuzi wa ugonjwa wa brusella kwa binadamu nchini Tanzania, ni tafiti chache sana ambazo zililenga kuripoti ugonjwa huo [6,7]. Tathmini kamili ya utendaji wa vipimo na gharama kwa vipimo vya uchuguzi vinavyotumika sasa zitaweza kutoa mwelekeo unaolenga kuboresha utambuzi wa ugonjwa wa brusela katika ukanda wa Africa ya Mashariki na Kati. Hatua hii ni muhimu kupunguza athari zingine zinazotokana na ugonjwa. Tathmini ya uhamasishaji wa wafanyikazi wa afya walio mstari wa mbele juu ya ugonjwa wa brusela na utoaji wa taarifa za wagonjwa wa brusela kwa teknolojia ya elektroniki, itawezesha kuboresha utambuzi na kuripoti ugonjwa huu nchini Tanzania. Hatua hii itawezesha kupunguza athari zitokanazo na ugonjwa wa brusela.

MAONI KISERA

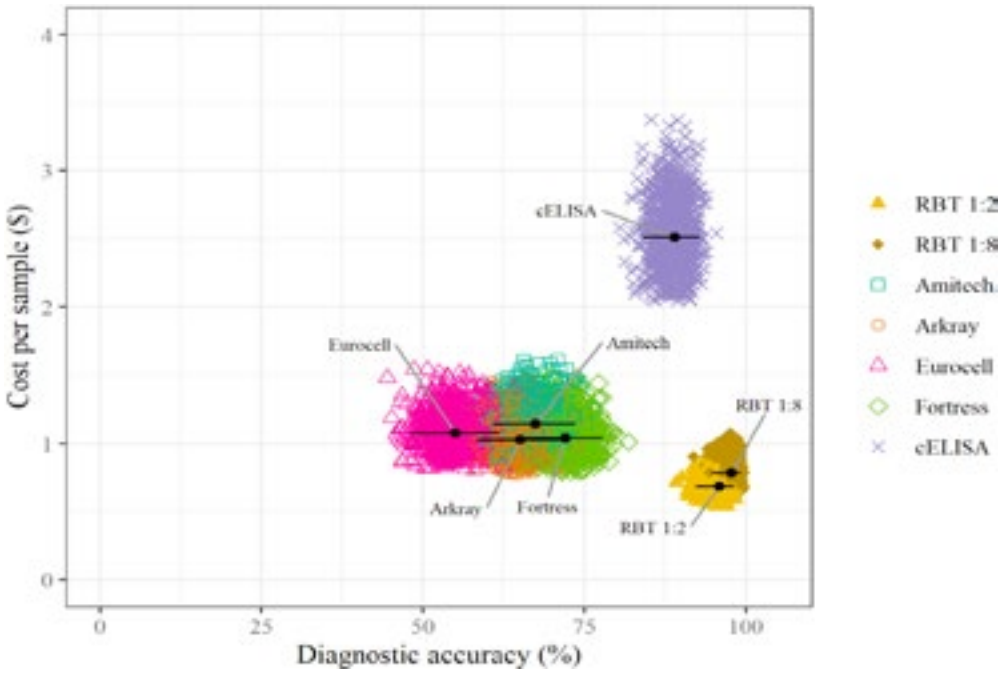
Maarifa juu ya utambuzi wa ugonjwa wa brusela kati ya wafanyikazi wa afya ni muhimu kwa kupunguza athari za ugonjwa. Mafunzo na uhamasishaji yalifanyika kwa wafanyikazi wa afya wa vituo vya kutolea huduma ya afya kama inavyooneka kwenye Kielelezo namba 1. Baada ya mafunzo, washiriki waliweza kutumia kipimo maalum cha RBT kugundua ugonjwa wa brusela. Kipimo maalun cha RBT ni cha bei nafuu na rahisi kutumiwa na wafanyikazi wa afya walio na ujuzi mdogo wa teknologia ya maabara. Kwa hivyo, njia iliyoratibiwa ya upimaji wa ugonjwa wa brusela katika vituo vya kutolea huduma ya afya inawezekana kuwa sehemu ya mpango mkakati wa kudhibiti magonjwa.

» Kipimo maalum cha RBT ni cha gharama nafuu na kinatoa majibu sahihi, kwa hivyo kinafaa kutumika katika mfumo mzima ya vituo vya kutolea huduma ya afya nchini. Kama ilivyoainishwa kwenye Kielelezo namba 2, uchunguzi kwa kutumia kipimo maalum cha RBT (0.7 USD) unagharimu karibu Dolla za Marekani (USD) 2.00 chini pungufu kulingana na kipimo cha cELISA (2.5 USD), karibia nusu ya gharama ya vipimo vingine vinavyouzwa (1.1 USD), na kwamba kina usahihi wa kutambua vimelea vya ugonjwa wa brusela kwa kiasi cha asilimia 95-98. Aidha, kipimo maalum cha RBT kinafanya uchunguzi kwa usahihi kuliko vipimo vingine vinavyouzwa kwa ajili ya uchunguzi wa ugonjwa wa brusela.

» Kuna haja ya kufikiria matumizi ya mifumo ya haraka, ya kielektroniki ya kutoa taarifa ili kuboresha ufuatiliaji wa ugonjwa wa brusela, kwa mfano mfumo wa utoaji taarifa kwa njia ya simu wa AfyaData [6]

Kielelezo 1: Mafunzo ya wafanyikazi wa huduma ya afya juu ya matumizi ya kipimo maalum cha RBT kwa upimaji wa ugonjwa wa brusela wilaya ya Kilosa, Morogoro.

(Picha kwa hisani ya Mligo Belinda)



Kielelezo 2: Gharama ya uchunguzi kwa kila sampuli dhidi ya usahihi wa utambuzi katika upimaji ugonjwa wa brusela. * Kipimo maalum cha RBT - Rose Bengal Test, cELISA (Lukambagire et al., Sci Rep 11, 5480 (2021).

HITIMISHO NA MAPENDEKEZO

Kipimo maalum cha RBT kinapima kwa usahihi, gharama yake ni nafuu, ni rahisi kutumia, na kinaweza kutumika kama kipimo cha kugundua ugonjwa wa brusela katika vituo vya kutolea huduma ya afya. Shughuli zingine za kudhibiti ni pamoja na kuendesha semina za mafunzo kwa wafanyikazi wa afya ili kuongeza uelewa wao juu ya ugonjwa wa brusela. Mafunzo haya pia yataboresha uwezo wa utambuzi wa kimaabara na ufuatiliaji wa matukio ya ugonjwa wa brusela kwa watu na wanyama ili kuongeza uwezo wa Tanzania wa kutibu na kudhibiti ugonjwa wa brusela. Hatimaye, matumizi ya mfumo mzima, matumizi yaliyoratibiwa ya kipimo maalum cha RBT na matumizi sahihi ya kipimo cha kuthibitisha uchunguzi kinahitajika. Hii itawezesha kuboresha takwimu za sasa juu ya ugonjwa wa brusela kwa binadamu na kuwezesha mikakati ya udhibiti inayoendelea.

KUMBUKA: Picha za ukurasa wa mbele zinaonyesha; 1. Soko la mifugo na mazao yake katika wilaya ya Ngorongoro. Ufugaji ni shughuli muhimu ya kiuchumi kwa watanzania wengi, ikiwa ni pamoja na ng'ombe, kondoo na mbuzi ambao wanachangia kwa kiasi kubwa katika usambazaji wa ugonjwa wa brusela kwa watu. Picha ya 2. Vipimo vya kupima ugonjwa wa brusela vinayotumika katika kituo cha kutolea huduma ya afya katika mkoa wa Arusha, kaskazini mwa Tanzania. Tafiti za hapo awali zinaonyesha vipimo vingi kwa uchunguzi vinavyotumiwa hivi sasa havina usahihi na hugharimu zaidi ya kipimo maalum cha RBT kinachopendekezwa (Picha kwa hisani ya L.A.S na Jo Halliday).

SHUKURANI

Utafiti huu uliwezeshwa na mpango wa udhamini wa masomo wa Afrique One-ASPIRE kwa kupitia mpango wa DELTAS Afrika (Afrique One-ASPIRE/DEL-15-008) pamoja na mradi wa ZELS unaotafiti uibukaji wa maradhi katika mifumo ya ufugaji (BB/L018845, BB/N503563/1 and BB/L017679). Utafiti huu ulipewa ruhusa kwa kupitia kamati ya maadili za utafiti ya KCMUCo (cheti na.698) pamoja na Taasisi ya Taifa ya Utafiti wa Magonjwa ya Binadamu (NIMR/HQ/R.8c/Vol. I/1140). Na(NIMR/HQ/R.8a/vol. IX/3235).

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