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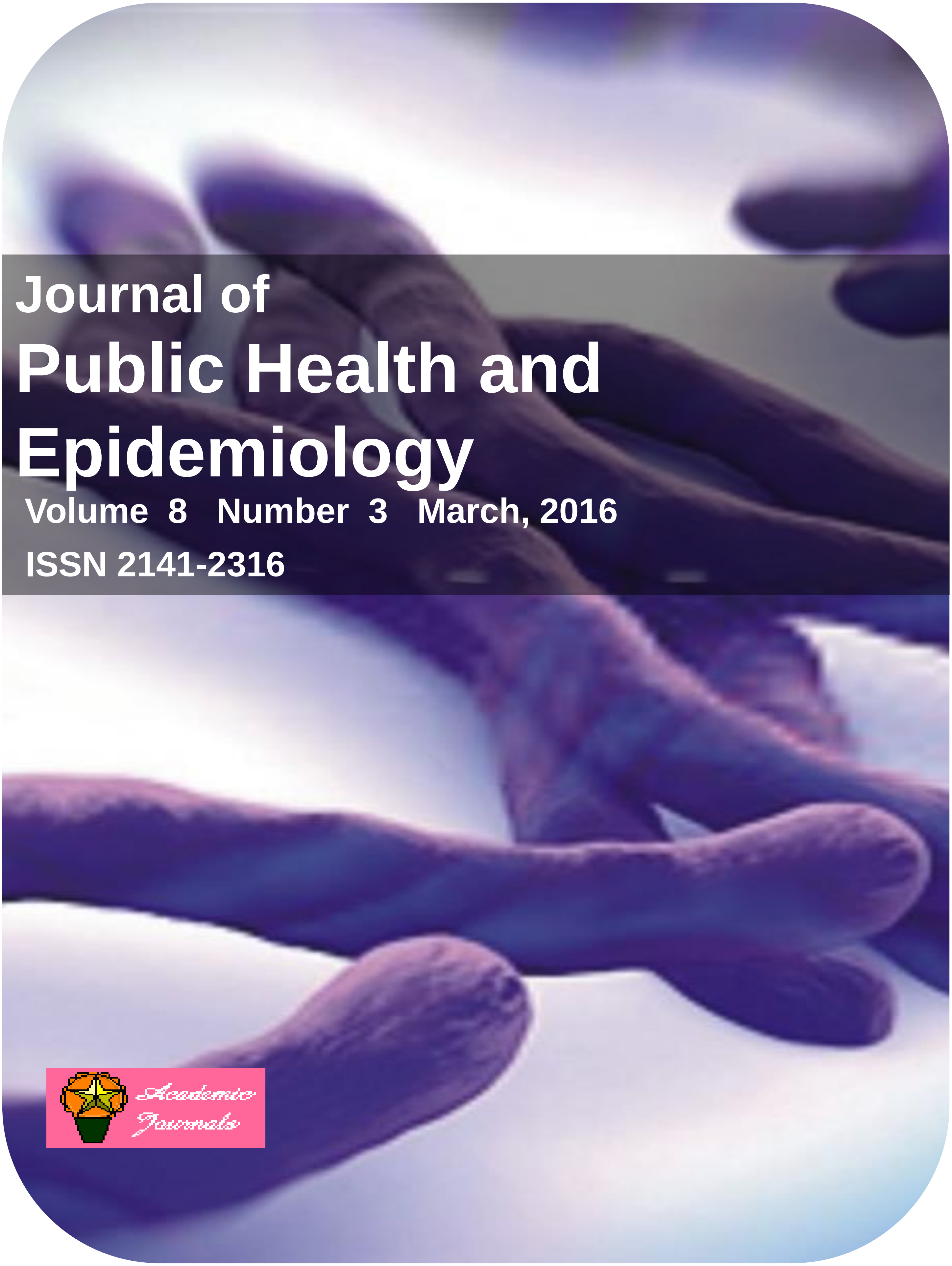

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Journal of Public Health and Epidemiology

Full Length Research Paper

National measles surveillance data analysis, 2005 to 2009, Ethiopia

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Measles is a well known vaccine preventable disease causing significant morbidity and mortality among children worldwide especially in developing countries like Ethiopia. A surveillance data was analyzed to describe measles cases epidemiologically and identify locations where case loads are high for further investigations. The National Measles/World Health Organization (WHO) guideline was used for case definitions and the final classification of cases. Selected variables from the database of the national measles surveillance data of 2005 to 2009 Ethiopia of were analyzed. Epi Info Version 3.5.1 and Microsoft Excel were also used for statistical analysis. A total of 17,521 cases and 127 deaths (Case Fatality Rate: 0.71%) were reported during 2005 to 2009. A total of incidence 5771 measles cases with an incidence of 7.6 per 100,000 populations were reported in 2008. The highest attack rate (12%) was observed in Hareri region. The majority (50.7% (8894)) of cases were from rural, 51.9% were males and the median age was 4 years old. About 4718 (26.9%) cases did not have a history of vaccination. Most IgM-antibody confirmed cases (40.5% (1216 of 3000)) were reported from Oromia region. The age group 1 to 4 years old constituted 41.7 (7323) and 34.4% (1032) of the suspected and IgM-antibody confirmed cases, respectively. Outbreaks occurred in Guji, West Arsi, West Haraghe and Sidama zones which showed the peaks of epicurve in January and February of 2008 and 2009. Except Tigray, Harar and Dire Dawa, all regions reported outbreaks. Although the national measles vaccination coverage in Ethiopia reached 72.2% in 2008, five regions were under 55% and repeated outbreaks were observed. Therefore, regions should improve measles vaccination coverage and early case detection. The seasonality of disease transmission and causes of outbreaks for the identified locations needs also further investigation and research.

Key words: Measles epidemiology, IgM antibody, surveillance data, Ethiopia.

INTRODUCTION

Measles is a highly infectious viral disease caused by a Morbillivirus, and for which humans are the only reservoirs. In a non-immune person exposed to measles virus, after an incubation period of about 10 to 12 days (range 7 to 18 days), prodromal symptoms of fever, malaise, cough, coryza (runny nose), and conjunctivitis appear. Within 2 to 4 days of the prodromal symptoms, maculo-papular rash appears behind the ears and on the face. The rash spreads to the trunk and extremities and typically lasts 3 to 7 days (WHO Afro Measles surveillance revised, 2004).

Most persons recover from measles without complications. Some complications are associated with measles due to transient suppression of cellular immunity, which is a characteristic feature of the disease. Frequent complications in children less than five years of age include otitis media (5 to 15%) and pneumonia (5 to 10%) (WHO South East Asia regional office, 2009). Transmission is primarily person-to-person via aerosolized droplets or by direct contact with the nasal and throat secretions of infected persons. Individuals with measles are infectious 4 days before through 4 days after rash onset (WHO Afro Measles surveillance revised, 2004).

Despite the existence of a safe, effective, and inexpensive vaccine, measles is still not being controlled in many parts of the world. However, the use of measles vaccine over the last 30 years has reduced global measles morbidity and mortality by 74 and 85%, respectively, compared with the pre-vaccine era (Cutts et al., 1999). The World Health Organization (WHO) estimates that almost one million measles-related deaths occur each year, the majority (85%) in Africa and Asia (MMWR, 1999; Altintas et al., 1996).

Measles is widely known in Ethiopia and it has many names in various ethnic languages, for example, *Kufign, Ankelis or Shifto*. In 1980, Ethiopia introduced measles vaccination as part of the Expanded Programme on Immunization (FMOH Measles Guideline, 2007). A single dose of measles vaccine is recommended at 9 months of age (Cutts et. al., 1994; Global Advisory Group II Measles Wkly Epidemiol Rec, 1993; De Quadros et al., 1996). Several developed and developing countries follow a strategy that differs in timing and in the number of doses delivered either through routine immunization or supplemental mass immunization campaigns (FMOH Measles Guideline, 2007). In determining the age for vaccination, countries must balance the consequences of an older age (lack of protection in the early months of life) and a younger age (reduced effectiveness). In many countries, where morbidity and mortality due to measles are uncommon in infants, choose an older age for vaccination (e.g., age 12 or 15 months). In other countries, where a high number of deaths due to measles occur in children aged <9 months, a younger age for vaccination has been advocated (Kiepiela et al., 1991; Tades and Ghlorghis, 1985).

However, during supplemental immunization campaigns, a single dose of measles is given, irrespective of the immunization and disease history status, to all children in the target age group (FMOH SIAs Field Guide Ethiopia, 2010). A study conducted in Ethiopia showed also that campaign vaccination elevated immunity in the target ages by between 30 and 50% or an average of around 40% (Nigatu et al., 2008).

In Ethiopia the importance of disease surveillance in guiding health planning and interventions was recognized for a long time and “Quarantine" rules were proclaimed in 1947 with emphasis on surveillance. Another legal notice was issued in 1951, binding all public health practitioners in the country to report communicable diseases. The "Public Health Proclamation No.200/2000” orders any individual who knows the existence of communicable diseases in his/her vicinity to report immediately to the nearest health institution and the institution receiving the report to take the necessary measures and report to the appropriate health authority. In 1948, an anti-epidemic service was established to deal with prevention and control of communicable diseases. In 1951, 35 priority diseases were selected and classified into first and second class to be notified to Ministry of Health (MOH), immediately or weekly as necessary. In the mid-1970`s, the anti-epidemic unit was converted to epidemic control and surveillance unit under communicable diseases control division, and vertical programs were conducting their own disease specific surveillance. After the health system reform in 1994, nineteen diseases (including those which were under vertical programs) were selected for surveillance and measles was also one of the priority (IDSR Ethiopia, 2002).

According to the National Public Health Emergency Management (PHEM) guide line, every suspected measles case should be detected, reported using the cases based form and undergo laboratory investigation (or the first five cases in the situation of outbreaks), and during an outbreak all cases must be entered on a line listing, investigated and reported to next higher level (FMOH Measles Guideline, 2007; FMOH SIAs Field Guide Ethiopia, 2010/2011).

Ethiopia has experienced numerous measles outbreaks and increasing morbidity. As a vaccine preventable disease, measles surveillance data analysis is critical to guide intervention and vaccination activities. So the aim of the study was to assess the measles trend in the country, describe measles epidemiologically and identify locations where occurrence of cases is high for providing further investigation of causes and guide interventions.

METHODS AND MATERIALS

Study area, population and period

Ethiopia is administratively sub-divided into nine regional states and two city administrations. According to the third Population and Housing Census in 1997 the country's total population estimated

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to be 73,918,505 with an annual growth rate of 2.6%. Of which, 50.5% (37, 296, 657) were males, 45.0% were under age 15 years old, 51.9 % were in the age group of 15 to 64 years and those aged 65 years and above were 3.2% (Population and housing census Ethiopia, 2008). The national measles surveillance data was analyzed from November to December, 2010 in Addis Ababa, Ethiopia.

Design and data collection

A descriptive study was undertaken on the national measles surveillance data of 2005 to 2009. Although the type of data was secondary the study passed through the following procedures to have it. First a concept paper was developed and submitted to the school of public health of Addis Ababa University for review. Then, the Ethiopian Public Health Institute (EPHI) public health emergency management (PHEM) center approved the request of a five year national measles data base to carry out this study. The data base has many field names(variables) but the study analyzed selectively such as age, sex, date of onset of illness, reporting zone and province(Regional state), date of sample collection, sent to and received by the national laboratory, no of vaccine doses, type of reporting form, final classification of cases and presence of outbreaks.

Case definitions

The national Public Health Emergency Management and WHO measles guidelines were used for the case definitions and the final classification of cases by the laboratory as it was kept in the data base (Global Advisory Group II Measles Wkly Epidemiol Rec 1993; PHEM Guideline Ethiopia, 2009; WHO Afro IDSR, 2008). According to the Federal ministry of health of Ethiopia-Public health emergency management, measles is one of the immediately reportable diseases under surveillance. Suspected cases and deaths of fever with rash illness filled with case-based reporting form with serum sample collected are sent and tested for IGM antibody at Central (EHNRI) virology laboratory. Line listing was also used during an outbreak for reporting of cases.

Suspected case

Any person with fever and maculopapular (non-vesicular) generalized rash and cough, coryza or conjunctivitis (red eyes) OR any person in whom a clinician suspects measles.

Confirmed case

A suspected case with laboratory confirmation (positive IgM antibody) or epidemiologically linked to confirmed cases in an epidemic. All suspected cases of measles are finally classified based on the adequacy of the blood specimen collected, and sample taken or not in to the following categories;

Laboratory confirmed*:* A suspected measles case that is investigated, including the collection of an adequate blood specimen (5 ml), and has serological confirmation of recent measles virus infection (IgM positive).

Epidemiologically linked: A suspected measles case that has not had a blood specimen taken for serologic confirmation, but is linked to a laboratory confirmed case (definitive serologic evidence of recent measles virus infection). Linked is interpreted as being in the same geographic area (place) during the infectious period (time) of a laboratory-confirmed case (person), that is, in the same district within 30 days.

Discarded: A suspected measles case that has been completely investigated, including the collection of adequate blood specimen (5 ml), but lacks serologic evidence of recent measles virus infection (that is, IgM negative).

Clinical / Compatible: A suspected measles case that has not had a blood specimen taken for serologic confirmation, and cannot be epidemiologically linked to a laboratory-confirmed case.

Statistical analysis*:* Descriptive statistical analysis was made using Epi Info Version 3.5.1 and Microsoft Excel.

Ethical issue*:* The national measles surveillance data of the public health emergency management / Ethiopian had been ethically cleared at of the public health emergency management (PHEM) center of the Ethiopian public health Institute (EPHI).

RESULTS

According to the national measles surveillance data which include case based and line listing; a total of 17521 cases and 127 deaths were reported throughout the country in the period between 2005 and 2009. Of the total suspected cases, about 50.7% (8894) were from rural site, 23.7% (4167) from urban and 25.4% (4460) not identified as rural-urban. About 51.9% were males, 0.34% with sex not reported and the median age was 4 years old and the age ranges from under 1 up to 79 years old.

The national measles vaccine coverage increased from 42% in 2002 to 72.2% in 2008 and an increased number of reported cases was also observed from 2005 to 2008 (Figure 1). In the five years of reporting period, only 6.4% (1120) of cases get two or more vaccine doses, 31.3% (5490) get one dose, 26.9%(4718) not vaccinated and 35.3%(6192) with unknown vaccination status. It was observed that the cumulative number of suspected cases for five years was continuously increasing between December and January (Figure 2). The highest number of cases and incidence [5771 cases (7.6 per 100,000 population/year)] was reported in year 2008 (Table 1).

In each month of the five year period, a minimum of 50 suspected cases were reported to the central level. As it is shown in the epidemic curve, sharp peak was from January to February, 2008 and 2009 (Figure 3). Through filtration of the data base for those specific months which showed the highest peaks in the epidemic curve zones/provinces such as; Guji, west Arsi, West Haraghe and Sidama reported the highest number of cases than any other zone in the country (Figure 3).

The outbreak in Guji started on 14/1/2008 and the highest peak was on 21/1/2009 and then continued to 5/2/2008. As it is shown in the Epi-curve (Figure 4), at

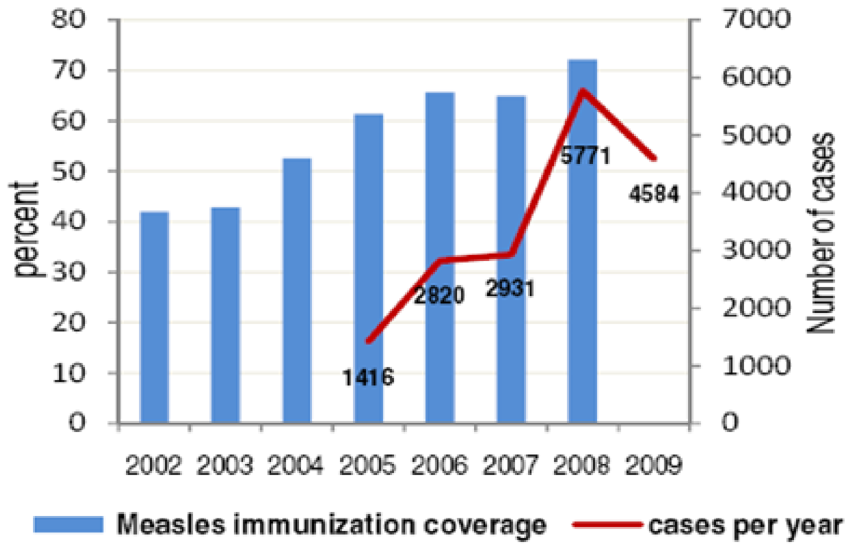

Figure 1. Measles cases and immunization coverage, 2005-2009, Ethiopia.

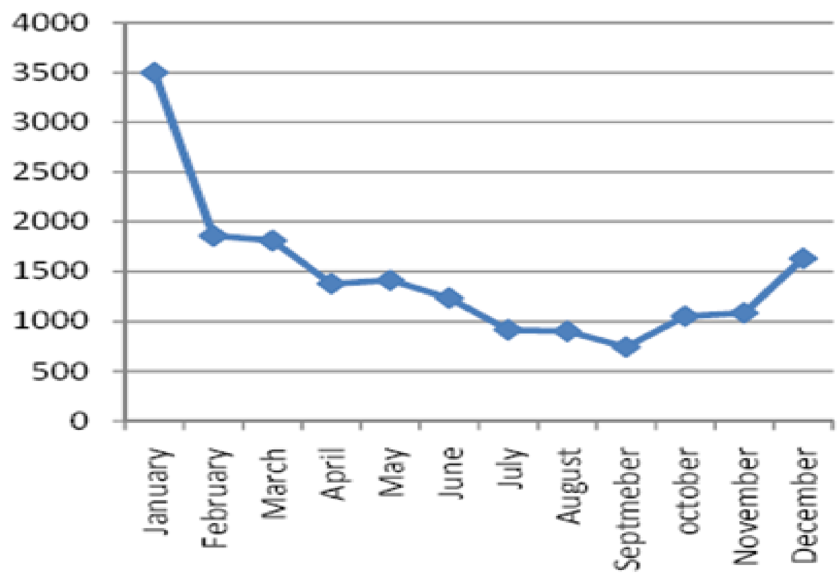

Figure 2. Trend of measles cases by month of onset of illness, 2005 to 2009, Ethiopia.

least 40 cases per day were reported even after the highest peak. A total of 1606 suspected cases were reported during the two months of an outbreak. 94.7% (1520) cases were under 15 years old, 45.6% (733) unvaccinated, 43.7%(702) get one dose, 1.1%(18) 2 doses, 9.5%(153) unknown status of measles vaccination.

In west Arsi, a total of 954 cases were reported in January 3 to 31, 2009 (Figure 5). During this period, 99.6% of the cases reported using a line list form. Measles vaccination status was not known in 99.6% (951) of the cases and only one case was vaccinated for first dose. Sex was evenly distributed (50%) and no death was listed in the data base.

In West Hararghe an outbreak occurred in February, 2007 (Figure 6) and two other outbreaks from March to April and December, 2008. A total of 237 cases reported in December, 2008 which were higher than the cases that

Table 1. Distribution of cases per 100,000 population per year, 2005 to 2009, Ethiopia.

Year	Population	Cases	Cases per 100,000 pop.
2005	54867674	1415	2.57
2006	56294233	2820	5.00
2007	73918505	2931	3.96
2008	75840386	5771	7.60
2009	77812236	4584	5.89

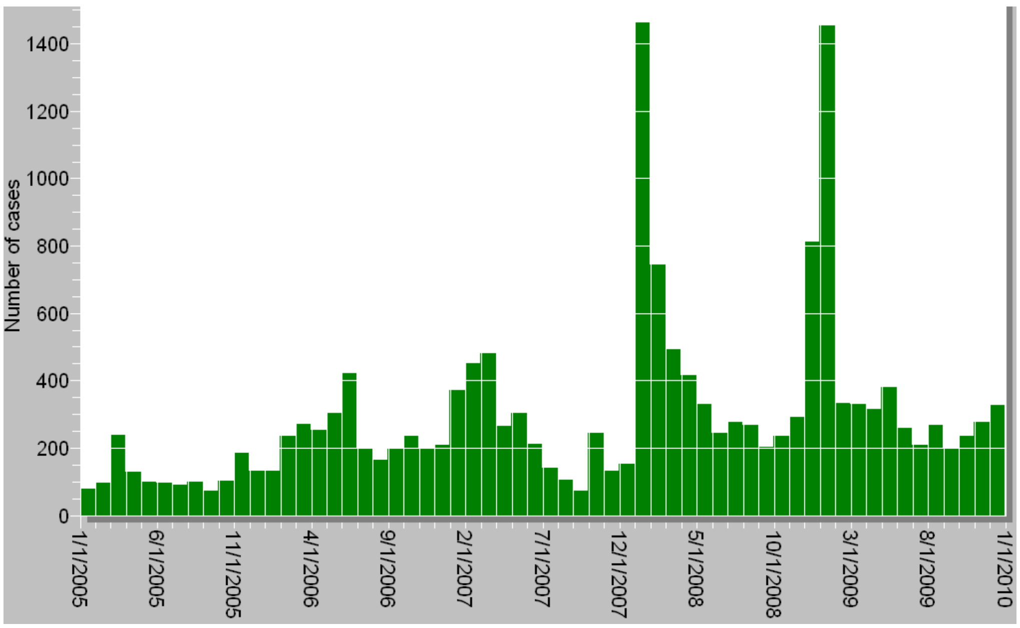

Figure 3. Epi-curve of suspected measles cases by date of onset, from 2005 to 2009, Ethiopia.

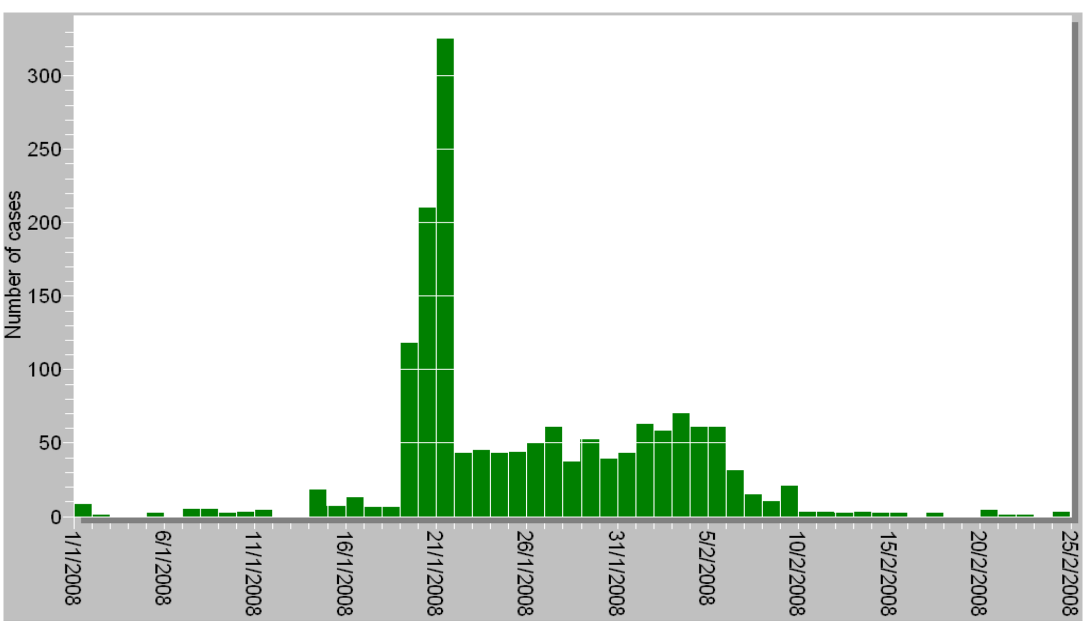

Figure 4. Epicurve of measles outbreak by date of onset Guji Oromia, Ethiopia, January to February, 2008

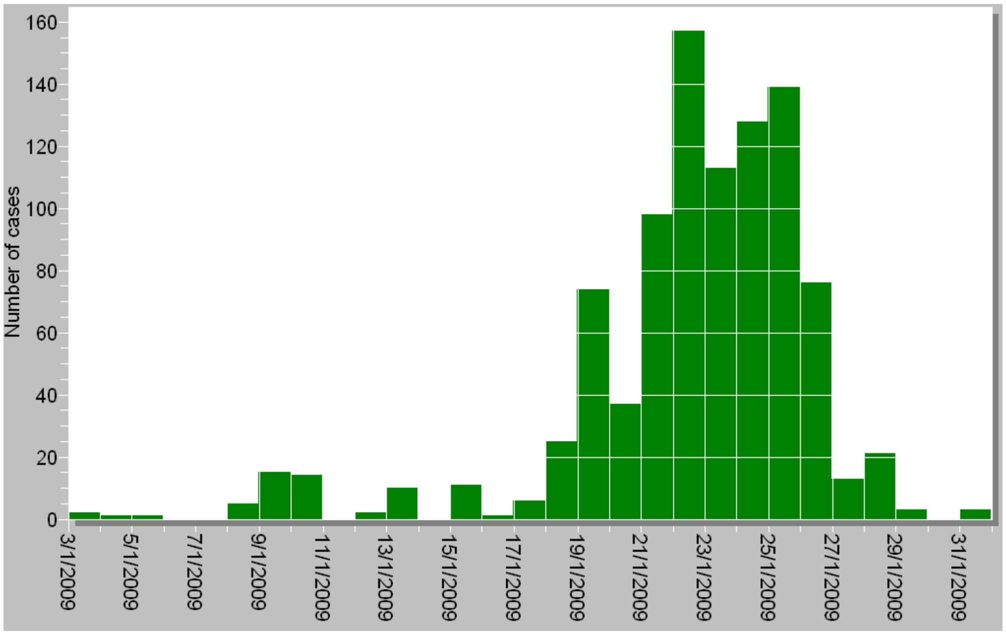

Figure 5. Epicurve of measles outbreak by date of onset in west Arsi, Oromia, January 2009.

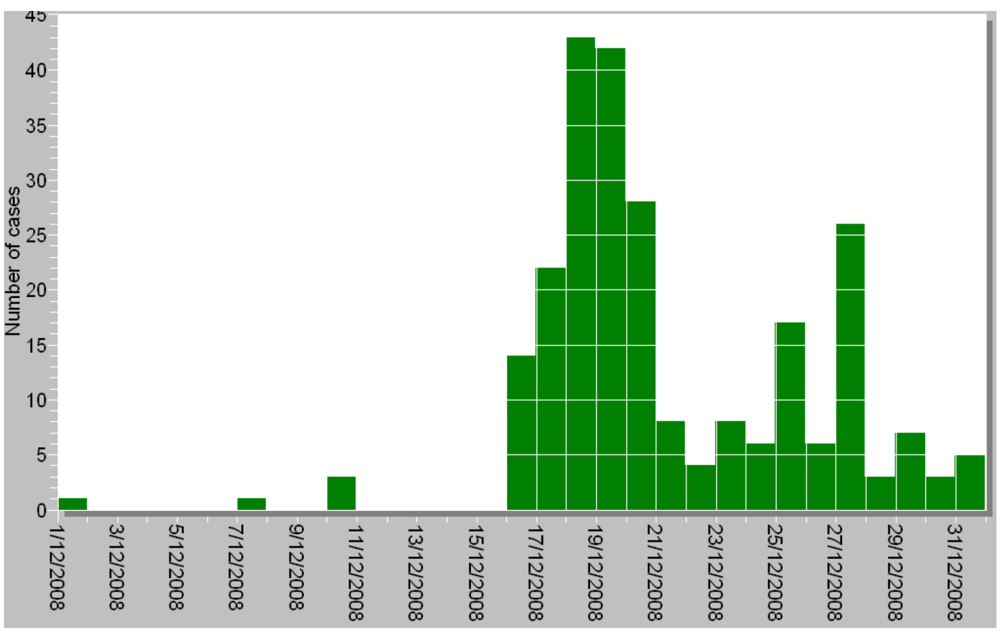

Figure 6. Epicurve of measles outbreak in West Hararghe, Oromia, Ethiopia, December, 2008.

occurred in previous three outbreaks (February, 2007, and March to April, 2008). 54.7% (135) of the cases were females, 89.1% (220) were under the age of 15 years and only 17 cases have got one dose of measles vaccine.

In January 2009, there was also an outbreak in Sidama zone/province with 236 reported suspected cases (figure 2.1.7). 50.4% (119) were females, 55.1% (130) unvaccinated, 35 % (92) with vaccination history (one and more doses) and 5.9% (14) with unknown vaccination status and one death. Fourteen cases from Guji, 4 from West Arsi, 6 from West Haraghe and 21 from Sidama zones were confirmed for measles IgM antibody collected during the occurrence of increased number of

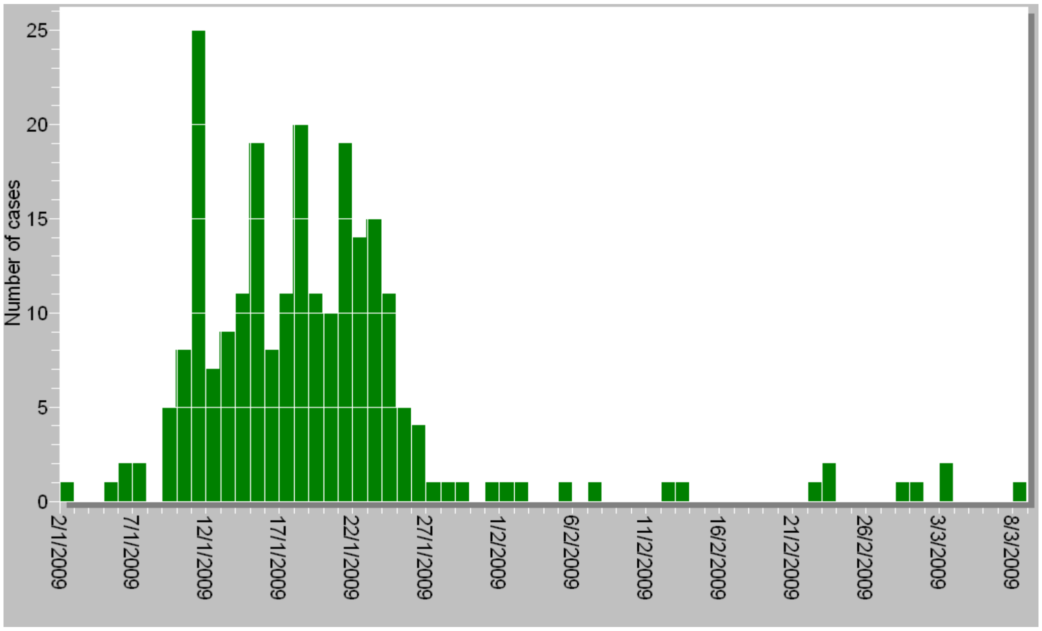

Figure 7. Epicurve of measles outbreak by date of onset in Sidama, SNNPR, Ethiopia, January, 2009.

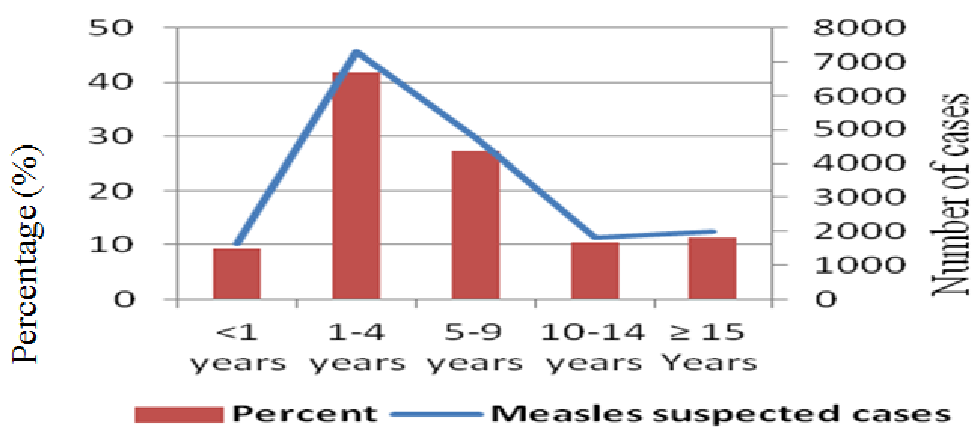

Figure 8. Distribution of measles suspected cases by age category from 2005 to 2009, Ethiopia.

cases as depicted in the respective Epi-curves shown earlier.

During 2005 to 2009 period, the age group 1 to 4 years old constitute 41.7 % (7323) of the total suspected and 34.4% (1032) of the confirmed cases by laboratory measles IgM antibody. 9.3% (1632) of the suspected and 6.5% (197) of the laboratory confirmed were under 1 years old (Figures 8 and 9).

A total of 11,841 serum samples were collected and sent to the national laboratory (EHNRI).The highest annual proportion of samples collected was 67.3% (3087) in 2009 followed by 86.4%(1224) in 2005. The highest (31.1% (913)) confirmed cases of measles IgM antibody was reported in 2007 and the least (9.7% (447)) was in 2005 (Table 2). 50.9 % (1524) of measles IgM confirmed cases were males during 2005 to 2009.

From all regional states, Oromia ranked first by notifying 44.8% (7861) of the national total suspected cases during the five years period. Somali and The Southern Nations Nationalities and Peoples' (SNNP) regional states detected the highest (48.8% (153)) and lowest (12.4% (356)) proportion of confirmed IgM positive of their own total suspected cases respectively. But from total national confirmed IgM positive cases, Oromia regional state also accounted first with a proportion of 40.5% (1216) (Table 3).

All regions/city administrations and 102 zones in the country reported cases in each year and at least in one

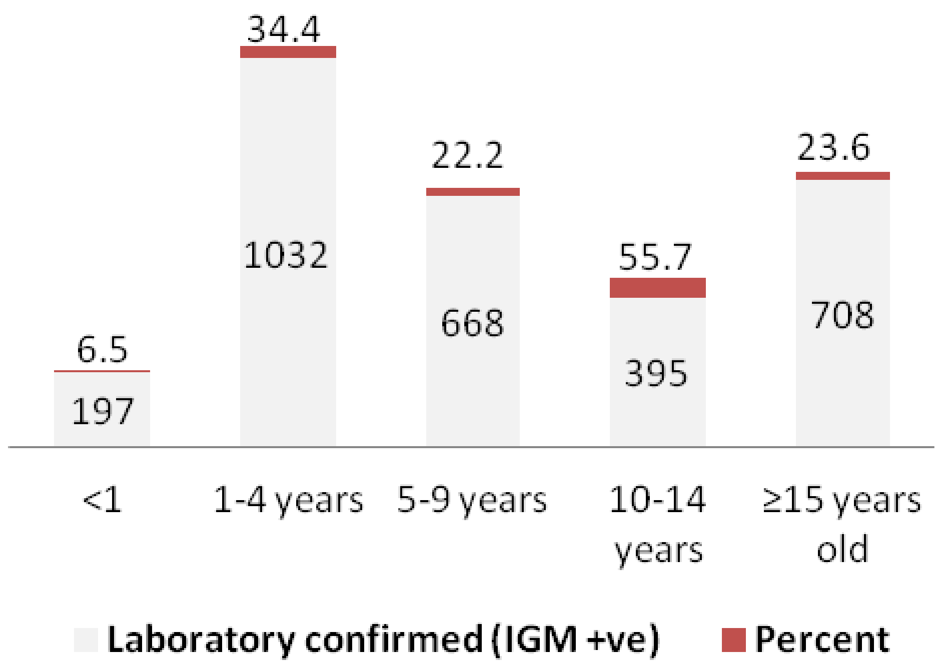

Figure 9. Distribution of measles laboratory confirmed cases by age category from 2005 to 2009, Ethiopia.

Table 2. Frequency of measles cases by final classification from 2005 to 2009, Ethiopia.

Year	Confirmed (IGM +ve)	Discarded (IGM -ve)	Epi linked	Clinical / compatible	Total cases	% IgM positive
2005	200	159	73	983	1415	14.1
2006	821	549	81	1369	2820	29.1
2007	913	533	53	1432	2931	31.1
2008	619	2892	63	2197	5771	10.7
2009	447	1527	679	1931	4584	9.7
Total	3000	5660	949	7912	17521	17.1

year respectively. In all five years period, the attack rate for measles sustained more than 2% in Harari regional state. From all regions the highest attack rate (12.9%) was observed in Harari in 2008 and in Gambella. (5.4%) in 2009. Except in 2006, Oromia reported the highest number of cases in all other four years and 44.8% (7861) from the total cases of the country reported in in five years (Table 3).

From 102 zones reported during 2005 to 2009, a total of 17521 cases were notified. Guji zone constituted the highest (1724 (9.8%)) number of cases, followed by west Arsi 1423(8.1%), West Hararge 823 (4.7%), Sidama 791(4.5%) and North Gondar 725(4.1%). In 2006, 23.5% (24) of zones had zero report of measles cases followed by 16.7% (17) in 2005, but in 2009 all 102 zones reported suspected measles cases (Figure 10).

From the total of 17522 registered cases, 11842 (67.6%) were reported using case based forms and 5680 (32.4) were using line listing. 64.1% (3643) of the reports using the line listing were from Oromia region. Tigray, Harari and Dire Dawa had zereo report of line listing based data. Fourty five (45.1%) zones reported measles outbreaks from 2005 to 2009, of which Guji reported 1593 (28.2%), West Arsi 1100 (19.4%), West Haraghe 512 (9%), Sidama 320 (5.7%) and North Gondar 260 (4.6%) cases. Except Tigray, Harar and Dire Dawa all regions reported cases of an outbreak at least in two years from 2005 to 2009. Amhara, Oromia and SNNPR reported an outbreak in all four years except in 2005 (Table 4).

From 16 zones, 126 deaths were reported during 2005 to 2009 in which the highest number [23 (18.2%)] of deaths reported from Gujji 23 cases (18.2%) West Harerghe [21(16.6%)], and from zone 2 of Afar [14(11.1%)]. The overall case fatality for the five consecutive years of the country was 0.72%.

Table 3. Distribution of measles cases by regional sate and final classification from 2005 to 2009, Ethiopia.

Province of residence	Confirmed (IGM +ve), No (%)	Discarded (IGM -ve), No (%)	Epi linked No (%)	Clinical / Compatible, No (%)	Total suspected cases, No (%)
Tigray	102 (14.4)	0	49 (6.9)	554 (78.5)	705 (4.0)
Addis Ababa	298 (24.2)	43 (3.5)	98 (7.9)	788 (64.2)	1227 (7.0)
Afar	157 (31.9)	197 (40.0)	24 (4.8)	114 (23.17)	492 (2.8)
Amhara	526 (17.2)	778 (25.4)	196 (6.4)	1557 (50.9)	3057(17.4)
Ben-Gumuz	48 (16.7)	96 (33.4)	29 (10.10)	114 (39.7)	287 (1.6)
Dire Dawa	27 (45)	0	1 (1.6)	32 (53.3)	60 (0.3)
Gambella	28 (19.4)	105 (72.9)	2 (1.3)	9 (6.2)	144 (0.8)
Hareri	89 (17.1)	0	24 (4.6)	406 (78.2)	519 (2.9)
Oromia	1216 (15.4)	3654 (46.4)	348 4.4)	2643 (33.6)	7861 (44.8)
SNNPR	356 (12.4)	719 (25.17)	167 (5.8)	1614 (56.5)	2856 (16.3)
Somali	153 (48.8)	68 (21.7)	11 (3.5)	81 (25.8)	313 (1.7)
Total	3000 (17.1)	5660 (32.3)	949 (5.4)	7912 (45.1)	17521 (100)

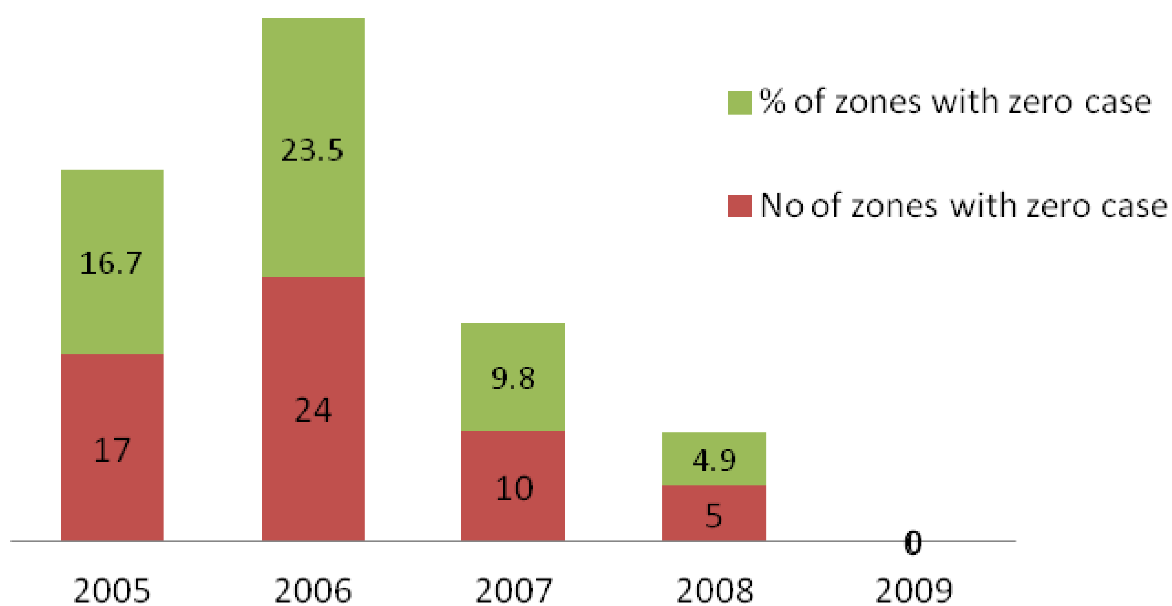

Figure 10. Frequency of zones with zero report of measles cases from 2005 to 2009, Ethiopia.

DISCUSSION

Measles immunization coverage of Ethiopia showed a progress from 42% in 2002 to 72.2% in 2008, and it was also indicated that, from 1998 the Federal Ministry of Health continued conducting measles supplemental immunization activities (SIAs). Moreover, recently the African regional goal; a >90% measles immunization national level coverage and a >80% coverage in all districts was adopted by the Federal Ministry of Health of Ethiopia (FMOH SIAs Field Guide Ethiopia, 2010/2011).

Nonetheless notification of measles cases increased year to year with a decline in 2009. It was also depicted by the Epi-curve that Ethiopia experienced outbreaks in 2008 and 2009 of January to February (Figures 3 to 7). This could probably also be due to improvement of measles surveillance activities such as notification of any suspected cases of measles. In Oromia region for example, of the total reported suspected cases of 2005-2009, 46.4% (3654 cases) classified as discarded. This might indicate an increase in awareness of notifying suspected cases of measles. As it was evidenced, among the total cases, 26.9% (4718) were vaccinated and 35.3% (6192) found with unknown vaccination status.

The two highest peaks of the Epi-curve (Figure 3) in January 2008 and 2009 were due to the outbreaks of Guji and West Arsi-Sidama zones. As it was shown in Figures 4 to 7 in Guji, West Haraghe, West Arsi and Sidama zones, an outbreak occurred for days with confirmation of laboratory of Measles IgM antibody in 30 days or less. Cases were not evenly distributed by age, and the most affected age group was observed from 1 to 4 years throughout the five years period (Figures 7 and 8). This could be the immaturity of immune system in this age group and it is also documented that in developing countries the most vulnerable children are between the ages of 9 months and 5 years (WHO, a field manual in emergencies, 2005).

Though an increased number of suspected measles cases notified in 2008 and 2009, the laboratory confirmed cases (10.7 and 9.1%, respectively) were much lower than the rest three years. This could be due to the occurrence of outbreaks in 2008 and 2009, which minimized the number of serum samples to be collected, i.e, no more serum sample collection after five laboratory confirmed cases during an outbreak.

The incidence of suspected measles cases in all five years was more than 2 cases per 100,000 populations/year, which kept Ethiopia as high burden of measles compared to all the other African countries (WHO-AFRO Measles Surveillance Feedback Bulletin, 2007).. The cumulative case fatality rate in five years period was too low (0.71%). This could be under reporting of deaths and weak surveillance activities to detect a case early which is a common situation like other causes of deaths in the country or it could be also due to improvement of case management in health facilities.

All big regions such as Oromia, Amhara, SNNP, and Tigray had low performance or proportion of detection of confirmed IgM positive cases. However except Ben-Gumuza and Harari all other regions and city administrations had good performance. This could be the fact that in big regions the notification of suspected cases was high and especially because of the occurrence of outbreaks in each year result in an increment of a denominator.

The highest attack rate (12.9%) in Harari and Gambela (5.4%) could not be also justified at this point; however the probable hypothesis might be cold chain management failure, low coverage of immunization and presence of many susceptible groups in the community. Three regions (Tigray, Harar and Dire Dawa) had zero report of measles cases in line listing form different from the rest of all other regions. The Tigray case could be explained by its consistent and higher vaccination coverage (above 74%) which is better from other regions, but the absence of outbreak in Hareri and Dire Dawa in five years period couldn't be explained so far. The seasonality trend of the disease or increase number of cases from December to February could not also be justified within the scope of this work.

The 80% or greater number of districts report of measles cases with a blood specimen collected within 30 days of rash onset is one of the primary indictors for the performance of measles surveillance (FMOH Measles Guideline, 2007).However, it couldn't be calculated because of the absence of districts list in the current database. But when the study observed by zone; 102 (100%) zones reported at least one measles case in 2009, 83.3% in 2005, 74.5% in 2006, 88.2% in 2007 and 93.1% in 2008. About 11, 829 (99.9%) samples arrived in a good condition (that is, adequate volume, no leakage, not desiccated) to the national measles laboratory, which meets the WHO's target of 90% or more.

Conclusion

A total of 17521 suspected and 3000 (17.1%) laboratory (IgM antibody) confirmed measles cases were notified at central or national level during 2005 to 2009. The overall case fatality rate was 0.71% for the same years period. Generally, there was a trend of increment of cases in January, February and March of the study years. The national vaccination coverage showed progress year to year though the vaccination coverage of five regions was still under 55%. Four zones (Guji, West Arsi, West Haraghe, and Sidama) were identified as places which were responsible for the sharp peaks in the national epidemic curve of the five years period because of the occurrence of outbreaks.

The age group 1 to 4 years was the most affected population by measles from all other age categories and 62.2% of the cases were not vaccinated for measles or with unknown status of vaccination. Oromia regional state constituted most of the suspected and laboratory confirmed measles cases, however the highest attack rate was observed in Hareri region. Tigray Dire Dawa and Hareri regions had no report of cases of an outbreak.

RECOMMENDATIONS

The FMOH and other partners should collaborate and strengthen regions for the improvement of measles vaccination coverage. The seasonality of disease transmission or occurrence of outbreaks could indicate when to conduct SIAs, and the needs for further investigation and research. The surveillance activities need improvement in early detection of cases, for the completeness of variables and specificity of reporting suspected measles cases especially during outbreaks. Improvement in the database management for ease analysis that is, for example health facility names were inconsistent and districts were not filled. Further investigation or research is necessary to find out causes of outbreaks for the identified locations.

Conflict of Interests

The authors have not declared any conflict of interests.

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Full Length Research Paper

Prevalence of *Schistosoma* and other parasites among female residents of some communities in Oyo State, Nigeria

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Prevalence of Schistosoma and other parasitic infections in 507 females (5-78 years) was determined in a cross-sectional study undertaken in seven communities of Oyo State, Nigeria. Urine and stool samples were examined, and 25.2% overall parasite prevalence was recorded. *Schistosoma haematobium* and *Schistosoma mansoni* prevalence was 5.5 and 0.3% respectively. *Ascaris lumbricoides* (11.4%), Hookworm (9.3%), *Strongyloides stercoralis* (0.6%), *Trichuris trichiura* (0.3%), *Taenia saginata* (1.2%) and *Entamoeba histolytica* (0.8%) were also identified from stool and *Trichomonas vaginalis* (0.3%) from urine of participants. *Schistosoma haematobium* egg intensity ranged between 100-145 eggs / l0 ml urine. PCV was determined for all participants, values ≤ 32% was recorded for 67.1% of the parasite positive participants and 100% of *Schistosoma* infections. A correlation (0.75, p > 0.05) was established between PCV and parasite intensity. *Schistosoma* infection was highest (13.5%) amongst 11-20 year olds but absent in women 41-50 year old. There was a positive correlation (0.90, p > 0.05) between age and *S. haematobium* egg intensity. *A. lumbricoides* and hookworm infections were predominant in children (1-10yrs) while women (21-30 years) had infections of all the identified parasites. Concomitant infections (2.2%) of *S. haematobium* with other parasites were recorded. The high prevalence of infections amongst women of child bearing age and adolescent girls with the attending low PCV suggests the importance of parasitic infections in these groups. This emphasizes the need for intervention measures targeted at all members of these communities to interrupt transmission.

Key words: Schistosoma species, intestinal parasites, PCV, female residents, Oyo State.

INTRODUCTION

Over a billion people in Sub-Saharan African, Asia and the Americas are infected with one or more helminth parasites, and of these, soil-transmitted parasites are amongst the most common infections world-wide. More

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than 1.5 billion people (24% of world population) are infected with soil-transmitted helminthes (WHO, 2012). They affect the poorest and most deprived communities and represent more than 40% of the tropical disease burden, excluding malaria (WHO, 2003). The main species of helminth parasites transmitted through contaminated soil include *Ascaris lumbricoides, Trichuris trichiura* and the hookworms (*Ancylostoma duodenale and Necator americanus*). Hookworms are important parasites posing threats to the health of adolescent girls, women of reproductive age and to the outcome of pregnancy because the highest intensity of the infections occurs in this population (WHO, 2012).

Schistosomiasis, a fresh water borne disease caused by helminth parasites of the genus *Schistosoma*, is endemic in 74 countries in tropical and sub-tropical areas of the world with 50 million people at most risk in 52 countries (WHO, 2012). Schistosomiasis is widely distributed in Latin America, Middle East, Africa (Adenowo, 2014) It is also endemic in several parts of Nigeria (Ogbe, 1995). In Nigeria, schistosomiasis has a long history and is caused by two *Schistosoma* species: *S. haematobium* and *S mansoni*. *S haematobium* is more widespread (Banji *et al.,* 2012). Transmission of schistosomiasis is dependent on human-water contact and the extent and duration of contact in association with domestic and occupational activities (Ofulla et al., 2013). Infection appears to be correlated with frequency of water contact and women doing domestic chores in infected water are at greater risk. The amount of body surface exposed to water, enhancing cercarial contact during these activities is important in transmission (WHO, 2012). Age may also influence the extent and length of water contact. Morbidity and mortality are mostly associated with infections in school-age children, teenagers, young adults and women (Rollinson et al., 2013). Schistosomiasis has been known to have severe consequences for outcome of pregnancy in women. An observed difference in the prevalence of infection among sexes has been reported in previous studies (Mulugeta et al., 2013). Infections in women have been shown to be more easily transmitted to their sexual partners (Kjetland et al., 2006; Mbabazi et al., 2011). The health consequences of schistosomiasis may include anaemia and weight loss (WHO, 2012). Blood profiles help in the evaluation of the health condition of the individual to detect disease and it has been reported that mean haemoglobin level is affected by high parasitic load (Orji, 2015).

In many rural areas of Nigeria, little attention is paid to teenage girls and young adult members of communities during intervention programs because the majority of such schemes are directed at school children. The low level of the girl child's school enrollment in many such communities results in a low proportion of the female children benefitting from such intervention programs where available. Gender division of household tasks has been shown to predispose women and girls to schistosomiasis and other related parasitic infections as they are usually in charge of collecting water and washing clothes (WHO, 2008; McDonald, 2011). These girls/women remain sources of transmission in these communities. The non-participation of many girls from school-based intervention programs and the repeated exposure of girls and women to infection through domestic chores make them vital in the success of control programs. Therefore, this study determined the status of *Schistosoma* and other intestinal parasitic infections in the female members of some communities in Oyo State, South West Nigeria.

MATERIALS AND METHODS

Study site

A cross-sectional study was carried out in seven communities: Idikan, Basorun, Ajagba-Irepo, Olori, Omooba, Ajagba-Olaleye, and Akoda in Oyo State, South West Nigeria over a period of *5* months. Permission for the study was granted by the Oyo State Ministry of Health. Local health officials and the community leaders assisted in the mobilization of participants. The study was carried out according to the approved ethical procedures.

Participants' enrollment

Five hundred and seven (507) female members of the communities were recruited voluntarily into the study with the assistance of nurses and health workers at the primary health clinics in study areas after obtaining informed consent. Each participant was assigned a number, and given two 15 ml labeled screw-cap plastic bottles for urine and stool collection. Samples collected from participants were screened for presence of parasites. Pre-tested structured questionnaire was administered to the recruited participants to obtain socio-demographic information.

Sample collection and parasite detection

Urine (10 ml) was collected from each participant; each urine sample was centrifuged at 3,000 rpm for 5 min and then examined microscopically for presence of *Schistosoma haematobium* ova and other parasites. Egg count was carried out using the syringe filtration technique and expressed as eggs/10 ml of urine (WHO, 1993).

The initial screening of faecal matter for the presence of parasites was carried out by direct smear examination, followed by the examination of iodine stained smears and Formol-ether technique for concentrating and quantifying parasite ova (Cheesbrough, 2000). Ova, cyst, and larvae of parasites encountered in the samples examined were identified.

Blood (0.6ml) was collected from each participant into EDTA bottles, for the determination of the PCV, Hb count (Cheesbrough, 2000).

Statistical analysis

Results were subjected to simple percentages. Chi-square analysis was used to determine the relationship between the age and

Table 1. Prevalence of *S. heamatobium* infection in the age groups in the seven communities.

Age groups	Location							Total NE/ % Infected
	Basorun	Ajagba-Irepo	Olori	Akoda	Omooba	Ajagba-olaleye	Idikan	
	NE (% Infected)	NE (% Infected)	NE(% Infected)	NE (% Infected)	NE (% Infected)	NE (% Infected)	NE (% Infected)	
1-10	1(0)	9(0)	14(0)	3(0)	9(0)	0(0)	0(0)	**36(0)**
11-20	9(0)	10(0)	10(3)	11(0)	9(0)	24(3)	23(7)	**96(13.5)**
21-30	40(0)	14(0)	7(0)	18(1)	16(0)	12(0)	43(7)	**150(5.3)**
31-40	4(0)	23(0)	6(1)	9(1)	8(0)	12(0)	21(2)	**83(4.8)**
41-50	2(0)	18(0)	13(0)	5(0)	5(0)	12(0)	10(0)	**65(0)**
51-60	1(0)	23(0)	10(0)	3(0)	11(0)	10(2)	3(0)	**61(3.3)**
> 60	0(0)	0(0)	2(0)	4(0)	5(0)	0(0)	5(1)	**16(6.3)**
Total	57(0)	97(0)	62(4)	53(2)	63(0)	70(5)	105(17)	507 (5.5)

NE- Number examined.

prevalence. The multiple correlation co-efficient was used to find the relationship between egg counts and PCV.

RESULTS

The 507 participants were made up of traders, farmers, artisans, civil servants, and students aged between 5 and 78 years. Parasites were identified from 128 (25.2%) of the participants in all seven communities. *S. haematobium* ova was identified in the urine of 28 (5.5%) participants from four of the seven communities (Olori, Akoda, Ajaba-Olaleye, and Idikan). Egg intensity ranged between 100-145 egg/10 ml urine and the mean egg intensity was 123 eggs/10 ml urine. *S. haematobium* infection was identified in participants in the different age groups; the group of 11-20 years old had the highest (13.5%) prevalence while no ova were identified in subjects 1-10 and 41-50 years old (Table 1). Two individuals (0.3%) only, from Idikan, a semi-urban community, had *S mansoni* ova identified in their faeces. Idikan also had the highest prevalence (16.2%) of both Schistosome infections.

Other parasites identified include; *Ascaris lumbricoides,* Hookworm*, Trichuris trichiura, Trichomonas vaginalis, Strongyloides stercoralis*, and *Entamoeba histolytica* (Figure 1). *A. lumbricoides* had the highest prevalence (11.4%) while *T. trichiura*, *T. vaginalis* and *S. mansoni* were least (0.3%) prevalent. Concomitant infections of *S. haematobium* and other infections were recorded in 11(2.2%) of the study participants. Idikan had the highest occurrence (44.8%) of concomitant infection. All the parasite species identified were recorded for participants from this community.

A. lumbricoides was prevalent in all the age groups with the highest in the 31-40 year group (Figure 2), while hookworm was most prevalent in the 1-10 year age group. Participants 21-30 years old had infection of all the nine species of parasites identified, while only three parasite species were identified in women above 60 years.

A large proportion (40.3%) of the female participants had no formal education and 37.5% had only primary school education (Figure 3). Parasite infection was highest in participants with primary education. There was no infection recorded in women with tertiary (post-secondary school) education. The level of the educational attainment of the participants had a significant effect ($p<0.05$) on the infection status of participants.

Infection with *Schistosoma haematobium* was highest amongst the traders, while hookworm infections were highest amongst farmers and they also had a high prevalence of *A. lumbricoides* (Figure 4). Students made up 18.7% of the study participants and 8.4% of them had *S. haematobium*, 9.4%, *A. lumbricoides*, and 13.7%, hookworm infections. Traders were the 27.8% of the study population and 8.4% of them had schistosome infection.

Low PCV (< 32) was recorded in 67.1% of study subjects with parasite infections. The mean PCV value of the 128 infected individuals was 28.8% compared with 34.5% for the 379 uninfected individuals, while mean Hb value for infected participants was 9.5 gm/dl compared to 11.5 gm/dl for uninfected individuals (Table 2). PCV value <32 was recorded in all *S.haematobium* infected subjects and there was also a correlation ($r = 0.75$, $p > 0.05$)) between egg intensity and PCV counts of subjects with *S. haematobium* infection (Figure 5).

DISCUSSION

The results of the study showed the prevalence of parasitic infections amongst the female members of the study communities. The higher prevalence of *S. haematobium* compared to *S. mansoni* is in agreement

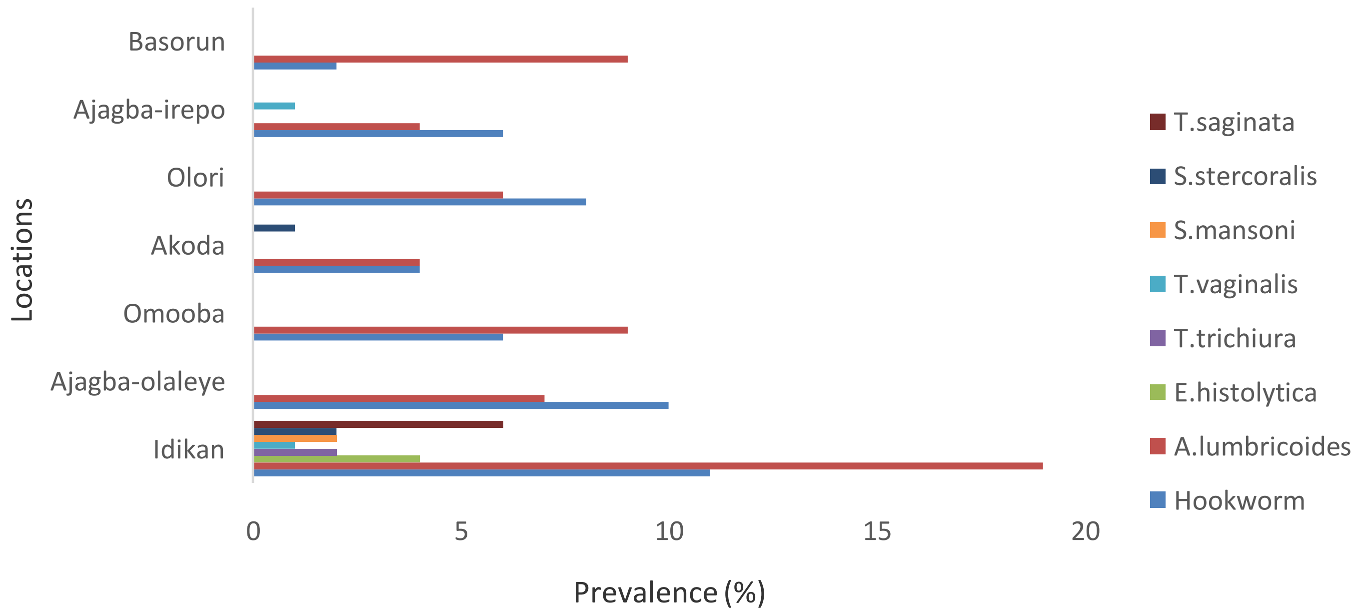

Figure 1. Prevalence of parasitic infections in the study communities.

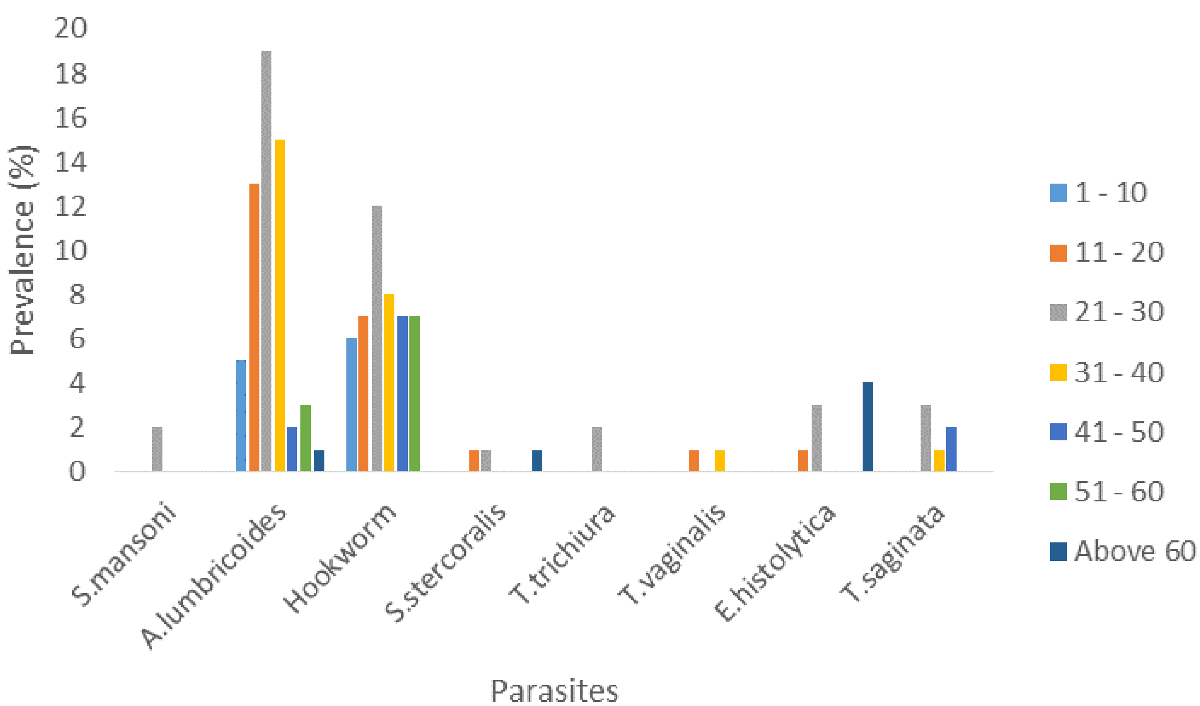

Figure 2. Distribution of infection in the different age groups.

with earlier studies which reported a higher *S. haematobium* infection in Nigeria (Ekpo et al., 2010; Adesola et al., 2012). Prevalence of infections had been linked to sanitary conditions in communities, proximity and frequency of contact with polluted water (Banji et al., 2012). Most of the communities in this study depend on river/stream as their main source of water, the frequent water contact by the female population increase the rate and length of exposure to the infective cercarial stage of schistosomes. Though Idikan a semi urban community

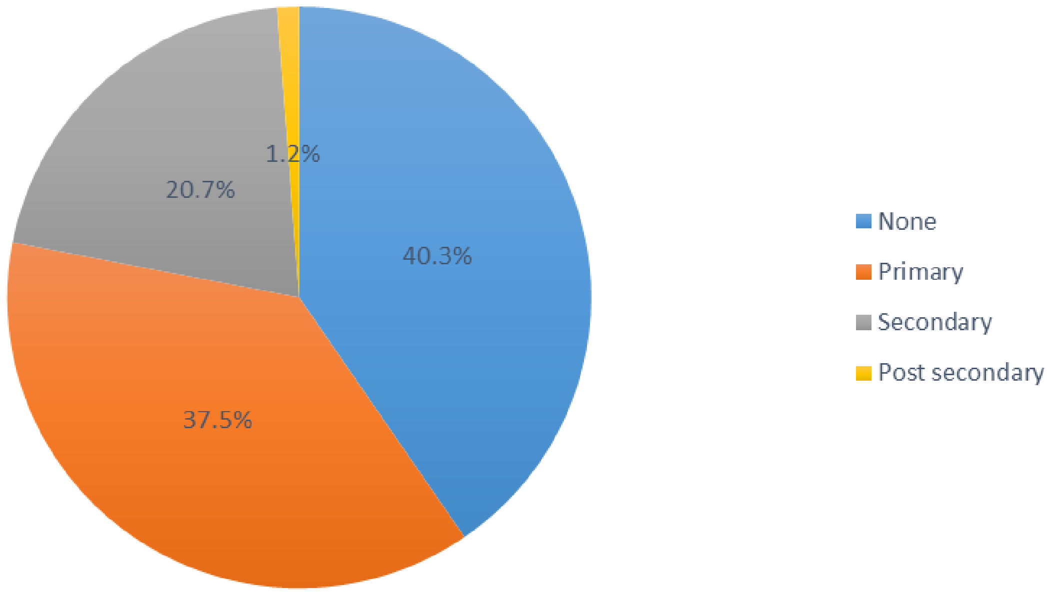

Figure 3. Proportion of study populations at various educational levels.

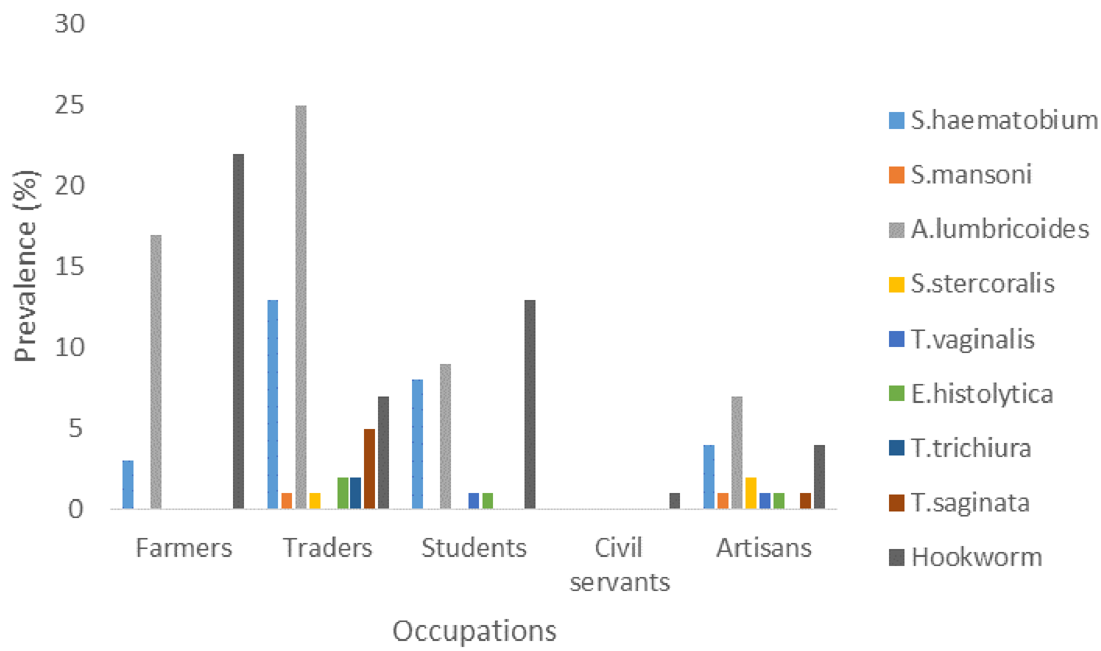

Figure 4. Distribution of Infection in the occupational groups.

had occasional access to pipe borne water, the prevalence of *S. haematobium* was high. This suggests that the river which serves as the main/alternate source of water is a viable transmission site. The variation in the prevalence of schistosome infections recorded in the different communities may be due to differences in exposure and duration of contact with cercaria infested water. Continuous contact with contaminated water source may result in multiple infections of the same subject over time. This could explain the positive correlation between age and egg burden.

The high prevalence of *Ascaris lumbricoides* and Hookworm in this study is in consonance with the report of Banji et al. (2012) in Niger State, Nigeria. A.

Table 2. Haematological parameters (Mean) with different parasites.

Parasites	Haematological parameters	
	Hb (gm/dl) Mean ± SE	PCV (%) Mean ± SE
S.haematobium	8.6 ± 0.9	25.9 ± 2.7
S.mansoni	10.1 ± 0.2	30.5 ± 0.7
Hookworm	9.4 ± 1.5	28.1 ± 4.5
A.lumbricoides	9.5 ± 1.6	28.6 ± 4.7
E.histolytica	8.7 ± 1.1	26.2 ± 3.3
T.trichiura	9.1 ± 1.2	27.5 ± 3.5
T.vaginalis	9.2 ± 0.7	27.5 ± 2.1
S.strongyloides	10.1 ± 1.0	30 ± 3.0
T.saginata	9.1 ± 1.2	27.2 ± 3.5
Uninfected	11.5 ± 0.1	34.5 ± 0.4
Infected	9.5 ± 1.6	28.8 ± 4.7

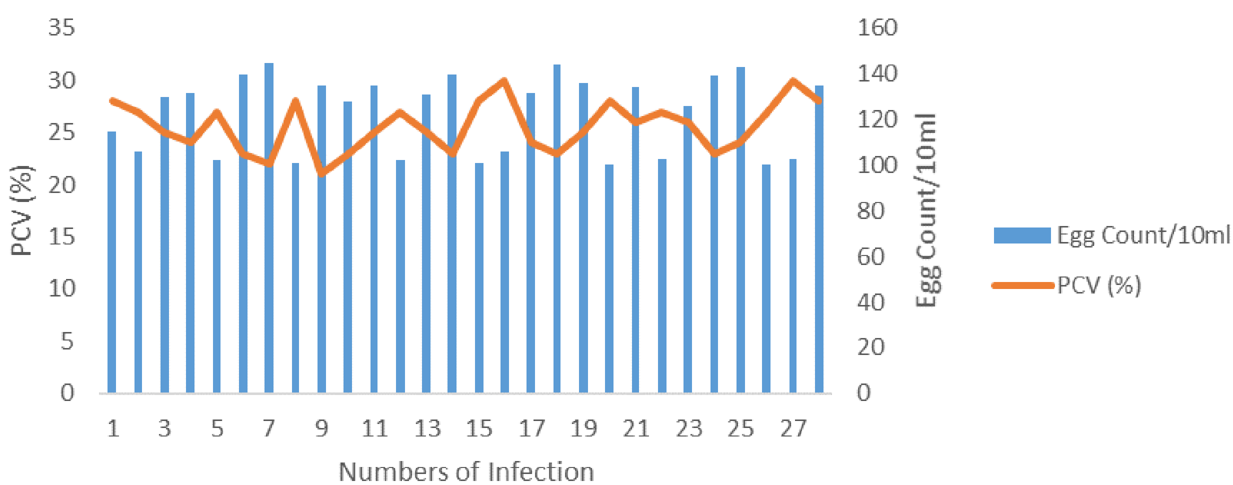

Figure 5. Relationship between *S.haematobium* infection and PCV.

lumbricoides and hookworms are some of the main parasite species transmitted through contaminated soils and are predominant in poor deprived communities with low sanitary conditions. Being in constant contact with soil is an occupational hazard for farmers and this explains the high rate of infection with these soil transmitted parasite in these female farmers. The contamination of water and soil by these parasites resulting from indiscriminate defecation and urination in the communities emphasizes the lack of basic social amenities and the low hygiene levels which make active parasite transmission possible.

The high prevalence of schistosome infection and relatively high levels of *A. lumbricoides* infections in girls (11-20 yrs) in the study were probably due to the social responsibility of carrying out household chores which brings them into close and constant contact with the infectious agents, also suggesting that these young girls contribute significantly to the pollution of the water sources. Schistosomiasis poses high risk particularly to female members of some African societies because of their multiple water-related activities. This was reiterated by Uyanga (1990). The lower prevalence of schistosome infection in the older women might be due to acquired immunity and decreasing exposure to infection because of fewer domestic chores. The low level of information or education amongst the study participants about the cause and symptoms of parasitic infections observed in this study maybe due to the low level of formal education of the study population. Also, as a result of this low level of education, it was observed that a high proportion of the women were engaged in low paying jobs or trade limiting their economic capabilities. Low socio-economic status has been known to play a major role in the epidemiology of parasitic diseases. Infections cause morbidity and this helps to maintain the vicious cycle of poverty, decreased productivity and inadequate socio-economic development as reported by WHO (2012). Anaemia (low haemoglobin count) was recorded in the study to increase with egg counts; this may have a deleterious effect on the haemopoetic status of infected participants. An association between *S haematobium* infection and high morbidity was also reported by Kjetland et al. (2006), King et al. (2010), and Mbabazi et al. (2011). Banji et al. (2012) also reported a correlation between prevalence of *S. haematobium* and haematuria. It is however important to note that in some communities in Nigeria, haematuria is well known but interpreted and explained in a traditional way and by culturally determined concepts (Akogun and Obadiah, 1996). Constant blood loss due to S. *haematobium* infection increases deficiency in iron and other minerals in women from menarche to menopause. This must have a considerable impact on their physical well-being, working capacity, and resistance to infection. Poor dietary habits, nutritional deficiencies, socio-cultural factors, and concomitant infections may interactively exacerbate the degree of anaemia in the subjects. The lack of information about the causes of parasitic diseases and ways to prevent transmission/infection may contribute immensely to the disease state in these communities.

Conclusion

It is highly conceivable that urinary schistosomiasis and presumably other intestinal parasites play a significant role in anaemia in women and girls. The resulting effect of these infections on the individual, households, and the entire communities could be severe. Consequences of parasitic infections on communities are multi-faceted and may be difficult to assess. It is therefore important that intervention programmes (surveillance and treatment) should be designed to include all members of the community. Also, basic social amenities especially potable water and toilet facilities should be provided for these communities.

Conflict of interests

The authors have not declare any conflict of interests

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