

Self treatment of Malaria and its management in communities of Guyana

R. Kurup* and H. Kumar

Faculty of Health Sciences, University of Guyana, Turkeyen Campus, South America

*Corresponding author: kuruprajini@yahoo.com

Abstract: In Guyana the continued high incidence of malaria is due to increased mining and logger's activities. In addition, behavioral patterns and attitudes of indigenous communities coupled with similar features in miners and loggers – all itinerant in nature- contribute significantly to interrupted/broken/incomplete treatments. This research assessed the use of self-treatment and also determined the various actions taken to manage malaria illness, especially among high risk individuals. This survey assessed the treatment-seeking pattern of malaria infection among fifty patients who visited Malaria clinic of Georgetown Public Hospital. Among the study population, 16% of the victims responded having sufficient information about malaria. Whilst most of the victims embraced the idea of self-administration (88%), 12% did not support the idea of self treatment. After careful examination, it was thought that the 12% of victims that was against self treatment may be as a result of advanced technology and availability of information on malaria like drug resistance and misdiagnosis. The study was able to draw trepidation of high risk malarial patients towards care and treatment. Self-treatment at home is the major action taken to manage malaria. Therefore efforts should be made to improve the availability of effective antimalarials to communities in rural areas with malaria, particularly through the use of community health workers, health posts, drug sellers, and shop owners. [R. Kurup and H. Kumar. **Self treatment of Malaria and its management in communities of Guyana.** *Nat Sci* 2014;12(1):87-92]. (ISSN: 1545-0740). <http://www.sciencepub.net/nature>. 13

Keywords: malaria; self-treatment; knowledge

1. Introduction

Malaria is a major health problem in the tropics and sub-tropics. The Center for Disease Control (CDC) estimates that there are 300-500 million cases of malaria each year and more than 1 million people die each year. It presents a major disease hazard for travelers to warm climates (1). According to the "World malaria report" 2011, there were 216 million cases of malaria and an estimated 655,000 deaths in 2010 (2).

Most of Guyana's population reside on a narrow coastal strip that is largely devoid of active malaria transmission however malaria remains endemic in the interior geopolitical regions, i.e., Regions 1, 7, 8, and 9. In this primarily Amazonian tropical rainforest district, the sylvatic *Anopheles darlingi* is considered the primary vector for malaria transmission. Population is very small and scattered, but there is a sizeable itinerant group of miners and loggers that moves not only throughout the interior and coastal areas of Guyana, but also into the neighboring countries of Brazil, Venezuela, and Suriname (3, 4, 5).

P. falciparum causes severe morbidity and mortality and continues to be the dominant species. The average number of malaria cases in Guyana was approximately 48,805 between 1991 and 1998 which were reduced during 1999 and 2000. In order to achieve malaria free areas such as in coast lands where 85% of Guyana's population resides, a new drug schedule was introduced in the latter-half of 1999 to treat *P. vivax* and *P. falciparum* malaria cases (6).

The aim of this study was to assess the knowledge of patients with regard to self treatment of malaria and management among malaria infected population of Guyana.

2. Materials and Methods

Study Area: Guyana is located along the north-eastern coast of South America. It is an English-speaking country with an area of 215, 000 km² and a population of approximately 770, 000. The population includes people of East Indian (49.5%) and African descent (35.6%) together with Amerindians (6.8%) and people of other ethnic groups (8.1%).

The study was conducted at the Malaria Clinic at Georgetown Public Hospital Cooperation. A sample of fifty (50) participants was randomly selected to voluntarily participate in this study during the month of September – November 2011.

Ethical Considerations: Ethical clearance was obtained from the Ethical Review Committee (ERC) under the Ministry of Health, Guyana. The objectives of the study were explained to patients who attended the clinic. Full verbal explanation of the study was given to members who participated in the study. Written consent was then obtained from malaria patients before inclusion as participants.

Data Analysis: The data were double entered in Microsoft Excel data sheets; cross checked and analyzed using SPSS 11.0. Descriptive statistics were carried out to measure relative frequencies, prevalence percentages and averages of the variables.

Table 1: Socio-demographic characteristics of respondents in Malaria clinic.

| CHARACTERISTICS | n | % |
|--|----|------|
| Gender | | |
| Male | 37 | 74.0 |
| Female | 13 | 26.0 |
| Age | | |
| < 20 | 12 | 24.0 |
| 20 - 29 | 15 | 30.0 |
| 30 - 39 | 11 | 22.0 |
| 40 - 49 | 7 | 14.0 |
| 50 - 59 | 4 | 8.0 |
| > 60 | 1 | 2.0 |
| Religion | | |
| Hindu | 7 | 14.0 |
| Christian | 33 | 66.0 |
| Muslim | 5 | 10.0 |
| Others | 5 | 10.0 |
| Marital status | | |
| Married | 22 | 44.0 |
| Single | 27 | 54.0 |
| Divorced/Separated/Widow | 1 | 2.0 |
| Ethnicity | | |
| East Indian | 16 | 32.0 |
| African | 11 | 22.0 |
| Portuguese | 1 | 2.0 |
| Amerindians | 3 | 6.0 |
| Mixed | 19 | 38.0 |
| Educational Background | | |
| No education | 1 | 2.0 |
| Primary | 9 | 18.0 |
| Secondary | 31 | 62.0 |
| Tertiary | 5 | 10.0 |
| Graduates | 4 | 8.0 |
| TYPE OF STRUCTURE IN HOUSEHOLD: | | |
| Type of Roof | | |
| Grass/Leaves | 2 | 4.0 |
| Tiles | 2 | 4.0 |
| Asbestos | - | - |
| Zinc | 41 | 82.0 |
| Canvas | - | - |
| Wood | 5 | 10.0 |
| Type of Wall | | |
| Cane | - | - |
| Cement Blocks | 26 | 52.0 |
| Clay Blocks | 2 | 4.0 |
| Bricks | 1 | 2.0 |
| Stones & Cement | 3 | 6.0 |
| Wood | 18 | 36.0 |

3. Results

A total of 50 patients with malaria were interviewed who attended malaria clinic at Georgetown Public Hospital. The study had 26% females and 74% males. Detailed socio-demographic characteristics are presented in Table 1. Majority of the patients were Christians (66.0%), mixed ethnic

group (38.0%), secondary level educated (62.0%) and single (54.0%). Almost 82.0% of respondents said they live in houses with zinc roof whereas only 52.0% said they have cement blocks for their walls, 36% said they have wooden walls.

Table 2 present the respondents' knowledge about malaria, as well as its transmission. All the participants said they have heard of malaria. The respondents said the source of information about malaria were from friends (17, 34%), family (16, 32%), Health facility (11, 22%), poster/pamphlets (5, 10%), and other sources (Radio, TV, community meetings, church, school, community center). All respondents associated the disease transmission with mosquito bites and 96% believed malaria could lead to death if not treated. About 60.0% people associated malaria transmission with the bites of mosquito which had fed on malaria patients, 40% of patients claimed that malaria was spread by dirty stagnant water, 1% responded that it was transmitted by touching infected person while 3% people have no idea how malaria is transmitted. 96% believed that malaria is prevalent at their working area and 30% believed malaria prevalent at residing area.

46% of respondent said they are well aware of malaria whereas only 48% said they are aware only to an extent and 14% said they don't know about malaria. Symptoms of malaria such as intermittent fever, headache, loss of appetite, vomiting and general body weakness, were most frequently mentioned. Other symptoms mentioned were cough, respiratory distress, abdominal pain, loss of appetite, diarrhoea, body pains, and loss of energy, rigor and cramps. The majority of the respondents visited a laboratory to confirm malaria whereas 26% did self diagnosis. It clearly showed that 86% of persons were treated by a doctor or physician while 14.0% of persons were not treated by a doctor. In total, 74% said that they had tried self treatment at home with 48% tried anti malarial drugs, 37.8% tried pain killers and 13.5% tried bush medicine.

Education level did not influence significantly the type of treatment respondents would select for malaria treatment. 22% of the participants initiated treatment several months of acquiring malaria, 18% after one month and 12% initiated treatment after a week. 36% participants said they received treatment after 4-7 days of getting malaria whereas 50% of the participants received treatment between 1-3 days. Main reasons given for a delay in initiating treatment and visiting health services after onset of malaria were inaccessible health services, financial problems, and lack of awareness. Ways known to prevent mosquito breeding, as well as treatment and therapy of malaria are demonstrated in Table 1.3. Based on the study conducted in Guyana, majority of respondents seek

treatment for malaria from drug stores, dispensaries/health centers, or hospitals. Home treatment and self treatment were also practiced by most respondents. Respondents said that anti-malarial drugs were bought from markets or shops because the shops has less waiting time (18, 48.6%), prior knowledge of the same drug (12, 32.4%), drugs were cheap (1, 2.7%), dissatisfaction with health services (6, 16.2%) and carelessness about the disease (6, 16.2). A total of 68% participants believed that the self treatment was effective.

The common anti malarial drug used by respondents were chloroquine (12.0%), quinine (4.0%), primaquine (2.0%), other drugs (18.0%), while 42.0% were not certain of the drugs they used. Based on information received, it clearly showed that 66.0% persons responded positively towards the initiative, 32.0% responded negatively, while the remaining 2.0% do not know whether or not self treatment of malaria would reduce mortality rate. Transportation, receiving medication easily, financial problems and poor advice were given as reasons for not receiving prompt and effective treatment.

Table 2: Reported knowledge on malaria by respondents in the malaria clinic

| Variable | n | % |
|---|----|-------|
| Heard of malaria | 50 | 100.0 |
| Source of information | | |
| Friend | 17 | 34.0 |
| Family | 16 | 32.0 |
| Posters/Pamphlets | 5 | 10.0 |
| Radio | 1 | 2.0 |
| TV | 4 | 8.0 |
| Community Meetings | 3 | 6.0 |
| Church | 1 | 2.0 |
| Community Center | 1 | 2.0 |
| Health Facility | 11 | 22.0 |
| School | 4 | 8.0 |
| Malaria could cause death if not treated? | | |
| Yes | 48 | 96.0 |
| Don't Know | 2 | 4.0 |
| Mosquito bites | 30 | 60.0 |
| Dirty Stagnant Water | 20 | 40.0 |
| Working without Rest | 1 | 2.0 |
| Don't Know | 3 | 6.0 |
| Mode of Transmission | | |
| Mosquito | 50 | 100.0 |
| Is Malaria prevalent in your working area? | | |
| Yes | 48 | 96.0 |
| No | 2 | 4.0 |
| Don't Know | | |
| Malaria prevalent in your Residing Area | | |

| | | |
|---|----|------|
| Yes | 15 | 30.0 |
| No | 28 | 56.0 |
| Don't Know | 7 | 14.0 |
| Are you aware of Malaria? | | |
| Well Aware | 23 | 46.0 |
| To an Extend | 24 | 48.0 |
| No Idea | 3 | 6.0 |
| Symptoms | | |
| Fever | 46 | 92.0 |
| Cough | 10 | 20.0 |
| Respiratory distress | 5 | 10.0 |
| Vomiting | 31 | 62.0 |
| Diarrhoea | 13 | 26.0 |
| Abdominal pain | 13 | 26.0 |
| Rigor | 3 | 6.0 |
| Sweating | 27 | 54.0 |
| Headaches | 40 | 80.0 |
| Chills | 28 | 56.0 |
| Body Pain | 30 | 60.0 |
| Loss of energy | 31 | 62.0 |
| Loss of appetite | 33 | 66.0 |
| Don't Know | 1 | 2.0 |
| Adequate information on Malaria | | |
| Yes | 7 | 14.0 |
| No | 36 | 72.0 |
| Don't Know | 7 | 14.0 |
| If No, What information would you like to get? | | |
| Information on Treatment | 14 | 28.0 |
| information on Prevention | 20 | 40.0 |
| Information of Control | 25 | 50.0 |
| Nature of Disease | 8 | 16.0 |
| Signs and Symptoms | 4 | 8.0 |
| Don't Know | 1 | 2.0 |
| Information be communicated through | | |
| Family member | 6 | 12.0 |
| Friend | 6 | 12.0 |
| Church | - | - |
| Radio | 6 | 12.0 |
| TV | 12 | 24.0 |
| Posters/pamphlets | 8 | 16.0 |
| Community health worker | 3 | 6.0 |
| Newspaper | 8 | 16.0 |
| Health Facility | 14 | 28.0 |
| Community meetings | 12 | 24.0 |
| Don't Know | 1 | 2.0 |
| Have you ever had Malaria? | | |
| Yes | 38 | 76.0 |
| No | 12 | 24.0 |

Table 3: Attitude and Practices of respondents towards Malaria treatment and therapy

| | | |
|--|----|------|
| What/who diagnosed for confirmation of malaria: within 24 hours after onset of illness: | | |
| Self/Family | 13 | 26.0 |
| Clinical (Health worker) | 10 | 20.0 |
| Laboratory | 25 | 50.0 |
| Not Diagnosed | 6 | 12.0 |
| (Overall diagnosis after onset of illness: | | |
| Self/ Family | 8 | 16.0 |
| Clinical | 10 | 20.0 |
| Lab Tests | 28 | 56.0 |
| Duration Since you got Malaria | | |
| One Week | 6 | 12.0 |
| One Month | 9 | 18.0 |
| Several Months | 11 | 22.0 |
| Not sure | 24 | 48.0 |
| How long after treatment received: | | |
| Same day | 7 | 14.0 |
| 1 - 3 days | 25 | 50.0 |
| 4 - 7 days | 18 | 36.0 |
| Treated by a doctor or physician: | | |
| Yes | 43 | 86.0 |
| No | 7 | 14.0 |
| Tried any medication without consulting doctor or pharmacist | | |
| Yes | 37 | 74.0 |
| No | 12 | 26.0 |
| If yes, what medication/remedy tried: | | |
| Antimalarials | 18 | 48.6 |
| Pain killers | 14 | 37.8 |
| Alternative medicine (Bush medicine) | 5 | 13.5 |
| Purchasing of antimalarial drugs without prescription – if yes, what is the cause: | | |
| Prior knowledge of the same drug | 12 | 32.4 |
| Less expensive | 1 | 2.7 |
| Save time | 18 | 48.6 |
| Peer influence | 1 | 2.7 |
| Illness was mild | 6 | 16.2 |
| Dissatisfaction with health services | 6 | 16.2 |
| Treatment effective or beneficial: | | |
| Yes | 34 | 68.0 |
| No | 3 | 6.0 |
| Compliance as it relates to taking malaria drugs: | | |
| Yes, I finished all the tablets prescribed | 39 | 78.0 |
| No, I sometimes forgot to take the pills | 4 | 8.0 |
| No, I didn't complete the entire treatment because I | 7 | 14.0 |

| | | |
|--|----|------|
| felt | | |
| Drug(s) taken to prevent malaria: | | |
| Chloroquine | 6 | 12.0 |
| Quinidine | 2 | 4.0 |
| Primaquine | 1 | 2.0 |
| Other | 9 | 18.0 |
| Don't know | 21 | 42.0 |
| Chloroquine & Quinidine | 3 | 6.0 |
| Chloroquine, Primaquine & Quinidine | 2 | 4.0 |
| Primaquine & Quinidine | 2 | 4.0 |
| Quinidine & others | 1 | 2.0 |
| Quinidine & Sulfamethoxazole | 2 | 4.0 |
| Chloroquine & Primaquine | 1 | 2.0 |
| Where purchase or get antimalarial drugs: | | |
| Malaria control programmes | 13 | 26.0 |
| Private clinic | 2 | 4.0 |
| Health post/ Health Center | 10 | 20.0 |
| Pharmacy | 18 | 36.0 |
| Market / Shop | 11 | 22.0 |
| Drug shop | 2 | 4.0 |
| Friend | - | - |
| Why prefer to buy antimalarial drugs from markets or shops/friends: | | |
| Close to home | 6 | 12.0 |
| Cheap | 6 | 12.0 |
| Easily accessible | 30 | 60.0 |
| Short waiting time | 8 | 16.0 |
| Other household member take malaria drugs: | | |
| Yes | 21 | 42 |
| No | 29 | 58 |
| Support keeping emergency malarial medication for self-administration: | | |
| Yes | 45 | 90 |
| No | 5 | 10 |
| If given the opportunity, what is your capability of self-administration: | | |
| Will be nervous / scared | 5 | 10.0 |
| Not sure | 10 | 20.0 |
| Will be confident | 35 | 70.0 |
| Factors that prevents receiving prompt and effective treatment for malaria: | | |
| Transportation (Too far) | 28 | 56.0 |
| Too expensive | 2 | 4.0 |
| Doesn't have time to seek treatment | 3 | 6.0 |
| Forgets to take pills as prescribed | 4 | 8.0 |
| Nothing, I readily receive treatment | 13 | 26.0 |
| Would self-treatment reduce mortality (death) rate: | | |
| Yes | 33 | 66.0 |
| No | 16 | 32.0 |

| | | |
|--|----|------|
| Don't Know | 1 | 2.0 |
| Could malaria be prevented: | | |
| Yes | 37 | 74.0 |
| No | 8 | 16.0 |
| Don't Know | 5 | 10.0 |
| Personal protective measures used to guard against malaria infection: | | |
| Use repellants | 20 | 40.0 |
| Use mosquito coils | 12 | 24.0 |
| Use mosquito nets | 42 | 84.0 |
| Close windows and Doors | 4 | 8.0 |
| Gauze wires in windows | 4 | 8.0 |
| Do nothing | 3 | 6.0 |
| Other - Treat drinking water | - | - |

4. Discussion

The study population appears to be relatively knowledgeable of the etiology, symptoms, and treatment of malaria. The majority of the population correctly identified mosquitoes as the disease vector. Studies conducted in Colombia and Nigeria found that the source of malaria, and means of transmission, were largely unknown (7, 8). However, not all studies have reported a poor understanding of etiology. Two studies in Guatemala reported that more than 90% of respondents recognized mosquitoes as the malaria vector (9, 10). In our study population there is still a significant number of respondents who believe that malaria can be contracted by drinking dirty water. One of the studies in Guatemala also found this belief to exist in more than 50% of their study population (10). Also, the population demonstrated a good understanding of the symptoms of malaria like fever, headache, chills and loss of energy. The level of knowledge of malaria transmission was also similar as in other studies (11).

The majority of respondents in Guyana also correctly identified anti malarial drugs as the treatment of choice. Some individuals however, did state that traditional bush medicines could cure malaria. This belief was also reported in nearly 50% of a study population in Guatemala (12). Nevertheless, the level of knowledge of malaria in Guyana's population appears to be relatively good, and may be related to the relatively good level of education and literacy of the study population.

Self-treatment with anti malarial drug is reported to be widespread in malaria-endemic countries. However, results obtained in Guyana suggested that majority of the respondents self treated with anti malarial drugs as in other parts of the world (13). While many individuals self-treated at home with anti malarial drugs before seeking medical attention, 26.0% of the cohort did eventually present to a health

care facility. Studies in Guatemala, Ethiopia, and Kenya found that more than 60% of individuals self-treated (usually with anti-malarials) and did not seek medical attention (14, 15, 16, 17). A similar study was conducted with technical support from MSH/RPM Plus during 2005 – 2006 among miners in Guyana, on availability and use of antimalarials. This study had only 11.3% participants who could identify the primary symptoms of malaria. 37.6% could self diagnose malaria and 46.7% received malaria treatment from a friend/boss or local shop (18).

In addition, the main delay in seeking medical attention in Guyana's population was comparable to the results reported elsewhere (10). Many of the respondents delayed seeking medical attention because transportation was not readily available. Although there are many clinics in close proximity to the towns around Guyana, individuals working in the interior often have to wait until they return home to obtain health services. This was especially true among those who contracted malaria while working in the mines where access to health services is limited, hence, would tend to reduce mortality (death) rate in Guyana.

More than one third of respondents waited for several days before seeking medical attention because they did not think they had a serious illness. Individuals who were infected with malaria for the first time were more likely to delay for this reason than were those who had been previously infected. This suggests that symptom recognition may be a problem in individuals infected for the first time.

Although it was conducted in a public clinic, the study population may not be representative of the general population. Majority of malaria infections in Guyana are known to occur in middle aged males working in the bush (19), and therefore the sample population is representative of the burden of the malaria disease. However, the results found in this study may be compared to previous studies which were also limited by the same factors (20).

5. Conclusion

In summary, the study concludes that individuals working in the interior often have to wait for several days to return to the coast where health services are widely available, hence, self – treatment of malaria is beneficial for curing the disease by creating awareness among general population, pharmacy owners and health care workers

Correspondence to:

Dr. Rajini Kurup
Faculty of Health Sciences
University of Guyana, Guyana
E-mail: kurup_rajini@yahoo.com

References

- Adedotun AA, Morenikeji OA & Odaibo AB. Knowledge, attitudes and practices about malaria in an urban community in south-western Nigeria. *Journal of Vector Borne Diseases* 2010; 47: 155–159
- Ahorlu CK, Dunyo SK, Afari EA, Koram KA, and Nkrumah FK, “Malaria-related Beliefs and behaviour in southern Ghana: implications for treatment, prevention and Control” *Tropical Medicine & International Health* 1997; 2(5): 488–499
- Charlwood JD. Biological variation in *Anopheles darlingi* Root. *Memorias do Instituto Oswaldo Cruz* 1996; 91: 391–398. View Record in Scopus | Cited By in Scopus (46) 6
- Deming MS, Gayibor A, Murphy K, et al. Home treatment of febrile children with antimalarial drugs in Togo. *Bulletin of the WHO* 1989; 67: 695-700.
- Giglioli G. Malaria in British Guiana: Part 111. Breeding habits of *A. darlingi*. Natural factors which limit the distribution of these species and of malaria. *Agricultural Journal of British Guiana* 1938; 1: 198–206 Anon (2000) PAHO, 2000.
- Available at: <http://www.paho.org/English/AD/DPC/CD/cartagena-4-guy.pdf>. [Retrieved on June 02, 2011]
- Hla-Shein T, Soe-Soe T, and Ne-Win K. The level of knowledge, attitude and practice in Relation to malaria in Oo-do village, Myanmar. *The Southeast Asian Journal of Tropical Medicine and Public Health* 1998; 29(3): 546–549
- Krogstad DJ. Malaria. In: Goldman L, Ausiello D, eds. *Cecil Medicine*. 23rd ed. Philadelphia, Pa: Saunders Elsevier. 2007: chap 366.
- Kannathasan S, Antonyrajan A, Srikrishnaraj KA, Karunaratne SH, Karunaweera ND, Surendran SN. Studies on prevalence of anopheline species and community perception of malaria in Jaffna district, Sri Lanka. *Journal of Vector Borne Diseases* 2008; 45(3): 231-9
- Klein RE, Weller SC, Zeissig R, et al. Knowledge, beliefs, and practices in relation to malaria transmission and vector control in Guatemala. *American Journal of Tropical Medicine & Hygiene* 1995; 52: 383-388.
- La Cruz ND, Crookston B, Dearden K, et al., “Who sleeps under bednets in Ghana? A Doer/non-doer analysis of malaria prevention behaviours,” *Malaria Journal* 2006; 5(61), [Retrieved on June 09, 2011]
- Lipowsky R, Kroeger A, Vazquez ML. Sociomedical aspects of malaria control in Columbia. *Social Science & Medicine* 1992; 34: 625-637.
- Okonofua FE, Feyisetan BJ, Davies-Adetugbo A, Sanusi YO. Influence of socio economic factors on the treatment and prevention of malaria in pregnant and non-pregnant adolescent girls in Nigeria. *Journal of Tropical Medicine & Hygiene* 1992; 95: 309-315.
- Plummer WB, Pereirab LP. Diminished *Plasmodium falciparum* sensitivity to quinine exposure in vitro and in a sequential multi-drug regimen: A preliminary investigation in Guyana, South America. *International Journal of Infectious Diseases* 2008; 12: e27–e31
- PAHO 2000; <http://www.paho.org/english/ad/dpc/cd/cartagena-4-guy.pdf>.
- RAVREDA – AMI Newsletter 2005. The Amazon Network for the Surveillance of antimalarial Drug Resistance (RAVREDA) and the Amazon Malaria Initiative (AMI) No. 4, July–September 2005.
- Ruebush TK, Zeissig R, Klein RE, Godoy HA. Community participation in malaria surveillance and treatment II. *American Journal of Tropical Medicine & Hygiene* 1992; 46: 261-271.
- WHO Global Malaria Programme -World Malaria Report 2012. http://www.who.int/malaria/world_malaria_report_2011/9789241564403_eng.pdf
- Snow RW, Peshu N, Forster D, et al. The role of shops in the treatment and prevention of childhood malaria on the coast of Kenya. *Transactions of the Royal Society of Tropical Medicine and Hygiene* 1992; 86: 237-239.
- Yeneneh H, Gyorkos TW, Joseph L, et al. Antimalarial drug utilization by women in Ethiopia: a knowledge-attitudes practice study. *Bulletin of the*
- WHO 1993; 71: 763-772.

12/27/2013