ZNPHI
ZAMBIA NATIONAL PUBLIC HEALTH INSTITUTE

The Health Press

Zambia's journal on public health, disease surveillance, prevention and control
Vol. 01 | Issue 03 | 08 April 2017

The Health Press - Zambia is published by Zambia National Public Health Institute, Ministry of Health Zambia since Jan 31, 2017.
Address:
Plot 13, Reedbuck Road, Kabulonga, Lusaka.

Email: editor.heathpress@znphi.co.zm
Website: http://znphi.co.zm/thehealthpress/
Suggested Citation: [Author Surname, Initial].[Article title].Health Press Zambia Bull 2017;01(3):[inclusive page numbers].
ISSN: 2520-4378

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EDITORIAL

Malaria elimination – where are we at?

By ML Mazaba

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Citation style for this article:
Mazaba ML. Malaria elimination – where are we at? Health Press Zambia Bull. 2017;1(3);[inclusive page numbers].

Malaria, a preventable and treatable parasitic infection caused by the *Plasmodium* parasite, and transmitted through a female *Anopheles* mosquito is a major contributor to global morbidity and mortality [1]. Malaria remains endemic in up-to 91 tropical and sub-tropical countries and territories. The 2016 WHO Malaria report indicates global incidence of 212 million cases (range 148 – 304 million) in 2015, with the WHO African region accounting for 90% of the new cases, followed by the South-East Asia Region (7%) and the Eastern Mediterranean Region (2%) with an estimated mortality of an 429 000 (range 235 000–639 000), of whom 303 000 were children under five years of age [2]. According to the WHO in 2016, there has been a decrease in malaria cases and deaths of 37% and 60% since 2000, respectively [3]. WHO reports a 21% malaria incidence and 29% mortality decline between 2010 and 2015. The rate of progress depends on the strength of the national health system, the level of investment in malaria control and a number of other factors, including biological determinants; the environment; and the social, demographic, political and economic realities of a particular country [4].

Various countries and regions have had different targets towards the control, elimination and in some cases eradication of Malaria. E*limination which* is the interruption of local transmission (reduction to zero incidence of indigenous cases) of a specified malaria parasite species in a defined geographic area is a global goal [4]. Those who have advanced still have the risk of importation of non-indigenous malaria. Countries are situated at different points

along the road to elimination [4]. A holistic global approach and effort is necessary to achieve a total elimination of this ailment. It requires new tools and strategies aimed at completely clearing the parasite from a given geographical area then globally [5]. In May 2015, the World Health Assembly (WHA) committed to a global elimination initiative by adopting the *Global Technical Strategy for Malaria 2016-2030* (GTS). This strategy though ambitious, achievable elimination goals for 2030 included milestones to track progress along the way including reducing malaria case incidence by at least 40%; reducing malaria mortality rates by at least 40%; eliminating malaria in at least 10 countries; and preventing a resurgence of malaria in all countries that are malaria-free by 2020. By 2015, 10 countries and areas reported fewer than 150 locally-acquired cases of malaria and another 9 between 150 – 1000 cases. However, less than half (40) of the 91 malaria-endemic countries are on track to meet the GTS milestone of a 40% reduction in malaria case incidence by 2020. An accelerated approach is required to ensure the global goal is achieved by 2030 [6]. WHO estimates that 21 countries are in a position to achieve this goal, including six countries including Algeria, Botswana, Cape Verde, Comoros, South Africa and Swaziland in the African Region [7].

Some countries and regions have made great strides in eliminating indigenous malaria transmission and been certified Malaria free by the World Health Organisation. Certification of malaria elimination is the official recognition by WHO of a country's malaria-free status which is granted when a country has proof that the chain of local transmission of all human malaria parasites has been interrupted nationwide for at least 3 consecutive years [8]. Between 1955 and 2015, 27 countries and two territories received WHO malaria free certification [9]. The WHO European region hit its 2015 target to wipe out malaria, with reduced number of indigenous malaria cases having dropped from 90 712 in 1995 to zero cases in 2015 [10]. Outside the European region, 8 countries reported zero cases of the disease in 2014 including Argentina, Costa Rica, Iraq, Morocco, Oman, Paraguay, Sri Lanka and United Arab Emirates while another 8 countries each tallied fewer than 100 indigenous malaria cases in 2014. Furthermore, 12 countries reported between 100 and 1000 indigenous malaria cases in 2014 [7]. Sri Lanka was certified malaria free in 2016, a truly remarkable achievement considering it was among the most malaria

affected countries in the mid-20th century. [11]. Although there is a declining incidence of Malaria in Africa, there is also a considerable uncertainty around the reported estimates according to Nkumama et al [12].

Zambia's elimination strategy goals spelt out in the National Malaria Strategic Plan (NMSP) 2011-2016, aim to eliminate local malaria infection and disease by 2020, maintaining a malaria free-status and preventing its reintroduction in country [13]. Malaria prevention and control in Zambia is a prominent sub-component of the Health, Water & Sanitation, HIV/AIDS of GRZ/UNICEF Country Programme 2011-2015 [14]. A desk review on malaria in Zambia between 2000 and 2010 revealed three distinct epidemiological strata after a notable malaria reduction (66%) in in-patient cases and deaths, particularly in 2000-2008. Although Zambia passed the Roll Back Malaria target of reducing malaria mortality by half between 2000 to 2010, malaria cases and deaths re-surged, increasing in 2009-2010 in the northern-eastern parts of Zambia [15,16]. Between 2000 and 2015 it was projected that malaria incidence would decline by 50-75% in Zambia [17] and in particular Mukonka et al [18] documented reduction in malaria morbidity and mortality in Nchelenge district following a scale-up of malaria control measures.

In this publication THP-Z features under the perspective, *Let's clear the smoke: Making bars and restaurants accountable for a smoke-free Lusaka* which suggests more penalties of public facility owners who allow smoking in their areas and 4 research articles including *Malaria Incidence in Zambia, 2013 to 2015: Observations from the Health Management Information System* which indicates an unstable incidence rate over a three-year period from 2013 to 2015. The paper indicates that generally the incidence of malaria in Zambia increased by 6% between 2013 and 2014, and then decreased by 18% between 2014 and 2015, resulting in an overall decrease of 12% for the 2013-2015 and more specifically an increase of 90 to 103 per 1000 (from 2013 to 2014) before dropping to 83/1000 in 2015 among pregnant women; *Challenges surrounding the response to road traffic accident emergencies at Ndola Teaching Hospital casualty department, Zambia* which determined to establish the challenges in attending to RTA victims that are faced at Ndola Teaching Hospital (NTH), Zambia; *Medical prescriptions pitfalls of acute upper respiratory tract infections in government healthcare facilities in Zambia* which

demonstrated over prescription and drug misuse for upper respiratory infections in Zambia and; *Condom use at last sexual intercourse among teenagers in Zambia: results from the Zambia Demographic and Health Survey, 2013-2014* which determined correlates for condom use at last sexual intercourse.

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PERSPECTIVES

Let's clear the smoke: Making bars and restaurants accountable for a smoke free Lusaka

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Citation style for this article:
Savory T, Mwanza M, Lumpa M, Chitala M. Keep our future generation alive: Reinforcing routine HIV testing & treatment among children in Zambia. Health Press Zambia Bull. 2017;1(2), [Inclusive page numbers]

Smoke-free laws protect non-smokers from unwanted second-hand smoke and resulting health effects.
The Zambia smoke-free law was passed in 2008, but no enforcement was done.
55% of bars and restaurants have cigarette smoke levels way above the suggested guidelines.
Making restaurants and bars accountable for ensuring their in-door premises are smoke free is one of the most effective way of enforcing the law.
Providing an incentive and re-training of the enforcers will make them carry out their duties more attentively.

The Problem

Second-hand smoke (SHS) is one of the most important and most widespread exposures in the indoor environment. It has been linked to several health outcomes such as respiratory infections, ischemic heart disease, lung cancer and asthma [1]. Globally about a third of the population is exposed to the harmful effects of smoking, and responsible for over 600,000 deaths every year, of which 53,000 were in Africa. These deaths were mostly caused by ischemic heart disease for adults and lower respiratory infections (LRIs) for children [2]. There are no risk-free levels of second-hand smoking and even just a small amount of exposure can cause immediate harm [3].

Smoke-free law protects the non-smokers from involuntary exposure to second-hand smoking and this in turn reduces the number of health outcomes from second-hand smoking. In Scotland, where the smoke-free law was implemented fully there was a reduction in smoking related diseases like asthma from 79.2% to 53.2% [4]. In Spain, the number of hospital admission from acute respiratory infection reduced by 16% after the smoke-free law was passed in 5 years [5].

The Zambian government in 2008, through the Ministry of Local Government passed the smoke-free law, banning smoking in public places. This law was passed but no

enforcement was done. It has been shown that only in hospitals and public transport are the public places complying with the law [6]. In 2014, 6 years after the law was passed 55% of the public places visited still had visible patrons smoking and the air pollution levels for cigarette was 69% over the suggested guidelines. Even the 45% of the public places visited and the immediate outdoor surroundings still had cigarette butts on the floor and the air pollution was still higher than the guidelines [7]. This is due to the lack of enforcement from the appropriate authority and not making public places owners accountable.

Policy options

In order to reduce smoking in public places, the smoke-free law that was passed in 2008 should be enforced. Policy options that can enforce the smoke-free law include, increase the fine paid by public places, training of the enforcers on the importance of the smoke-free law and public awareness.

Introduce Fines for Bars and Restaurants Owners in the Law

WHAT: Introduce fines of thirty thousand, three hundred and forty penalty units to be paid by public place owners who fail to comply with the smoke-free law.

WHY: Currently public place owners are not fined if they are caught allowing someone to smoke in a non-smoking area.

FEASIBILITY: High. The Law is already there and has to be amended by the Ministry of Local Government.

Training and Incentivizing Health Inspectors

WHAT: Re-educating the enforcers on the importance of enforcing the smoke-free law and offering an incentive for all non-compliance of the smoke-free law booked.

WHY: Passing the law on its own will not produce the desired effects of reducing smoking in public places. It requires people to ensure that the law is being followed and if anyone fails to comply, the consequences should follow through.

FEASIBILITY: Medium. The government can use the human resource department to organize an in-house training for the enforcers and using money generated from fines collected by the department.

Public Awareness

WHAT: Carry out a public campaign on the dangers of second-hand smoking and how they can report if anyone fails to follow the law.

WHY: The public need to be aware of the dangers of second-hand smoking and that it is their right to protection from exposure to tobacco smoke.

FEASIBILTY: Medium. The government needs money to be able to have a meaningful campaign as campaigns will have to be translated to the various local languages.

Recommendations

Making bar and restaurant owners accountable for ensuring that their in-door premises are smoke free and the enforcers have an incentive and re-training to enforce the law. This is both cost-effective and feasible.

For this strategy to be implemented, the Ministry of Local Government and Ministry of Health needs to review the implementation plan and organize money needed to pay for the incentives.

The Ministry of Local Government needs to amend the smoke-free law so that bars and restaurants owners are accountable of enforcing the law in their premises. A public awareness program on the amended law needs to be done by the Ministry of Health and Local Government. The Lusaka City Council will have to get some of the money from the fines collected and use that to pay the incentives.

Having bars and restaurants owners accountable for ensuring no smoking is done in-doors and ensuring the enforcers carry out their duties has been noted to be highly effective way of making sure there is compliance and is less costly to the government

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RESEARCH REPORT

Malaria Incidence in Zambia, 2013 to 2015: Observations from the Health Management Information System

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Citation style for this article:
Inambao AB, Kumar R, Hamainza B, Makasa M, Nielsen CF. Malaria Incidence in Zambia, 2013 to 2015: Observations from the Health Management Information System. Health Press Zambia Bull. 2017;1(3);[inclusive page numbers].

Malaria is a major cause of morbidity and mortality in Zambia, particularly in highly endemic areas and among pregnant women and children under 5 years. In 2014, 5.8 million cases were reported through the National Health Management Information System (HMIS). We seek to assess the current trends in malaria incidence, and assist policy makers in decision-making around malaria prevention and treatment priorities.

We extracted national and provincial data on malaria cases (clinical and laboratory-confirmed) reported in HMIS from 2013-2015. We calculated overall and age group-specific (under 5 years and 5 years old and above) malaria incidence using extrapolated census data, and calculated the proportion of cases that were laboratory-confirmed by rapid diagnostic test or microscopy.

National malaria incidence was 386/1000 persons in 2013, 409/1000 in 2014, and 335/1000 in 2015. North-western Province recorded highest total incidence, ranging from 867/1000 in 2013 to 847/1000 in 2015. In 2013, 51% of cases were laboratory-confirmed; however, this increased to 80% of malaria cases by 2015. The incidence of laboratory-confirmed malaria among pregnant women increased from 49/1000 in 2013 to 64/1000 in 2015.The incidence in pregnancy was highest in Luapula (131/1000 in 2013, 207/1000 in 2014 and 177/1000 in 2015). For three years, malaria incidence was higher among under 5 children (756/1000) compared to 5 years and older (275/1000).

Malaria incidence in Zambia has substantial variation by province and age-group, and possible increases in pregnant women. This study identified high incidence in North-western and Luapula Provinces as well as pregnant women and children under five. These provinces and risk groups should be prioritized for malaria prevention and control programs.

Introduction

Malaria is a major cause of morbidity and mortality in Zambia, particularly in highly endemic areas and among pregnant women and children under 5 years [1]. In 2014, 5.8 million malaria cases were reported through

routinely collected data in the National Health Management Information System (HMIS) [2].

Reducing the incidence of malaria is a national priority that requires a focused, comprehensive, and consistent approach in order to achieve the vision of "a malaria-free Zambia by 2030", as stated in the 2011-2016 strategic plan of the Zambian National Malaria Control Programme (NMCP) [1]. As part of Zambia's National Malaria Elimination Strategy, several interventions are implemented to reduce malaria; including universal insecticide treated bed-net (ITN) coverage and indoor residual spraying (IRS) in targeted areas. The plan also includes strategies to: improve malaria case management; improve diagnostic testing capacity and quality, increase coverage of three doses of sulfadoxine - pyrimethamine (SP) for intermittent preventive treatment in pregnancy (IPTp), establish a robust surveillance system, and establish a monitoring and evaluation framework [2].

Malaria research in Zambia has primarily focused on specific interventions and population sub-groups. Phiri et al, 2015 concluded that Indoor residual spraying was associated with reduced malaria incidence in Kaoma district in areas where it was implemented [25]. According to a study conducted in Macha, Norris et al, 2011 concluded that Proper LLIN care was a strong determinant of LLIN efficacy, indicating that education on the importance of LLIN use and care is key when distributing nets [26]. In a study conducted in Mansa by Tan et al, 2014, they found 26% failure rate of sulphadoxine-pyrimethamine (SP) giving the moderate prevalence of the quintuple mutant haplotype. They indicated that, despite the presence of resistance, SP retained some efficacy in clearing parasites in pregnant women, and may remain a viable option for IPTp in Zambia [27]. Chaponda et al, 2015 investigated the prevalence and the predictors of malaria infection among pregnant women residing in one rural district in northern Zambia. They concluded that the high burden of malaria detected by Polymerase Chain Reaction (PCR) in pregnant women was suggestive of a limited effect of past prevention efforts in this population [3]. To sustainably reduce this burden of malaria, they suggest strengthening existing interventions, and shifting approaches towards targeting of pregnant women and other high-risk groups [3]. Chanda et al, 2012 assessed the status of Zambian vector control implementing policies and strategies and concluded that solid, consistent, and coordinated policies,

strategies, and guidelines exist for malaria vector control [4]. Bennett et al, 2014 advocated for increased evaluation of national malaria control programs (and other national public health interventions) using routine data [5]. However, more research and surveillance is needed to improve the understanding of the overall epidemiology of malaria in Zambia.

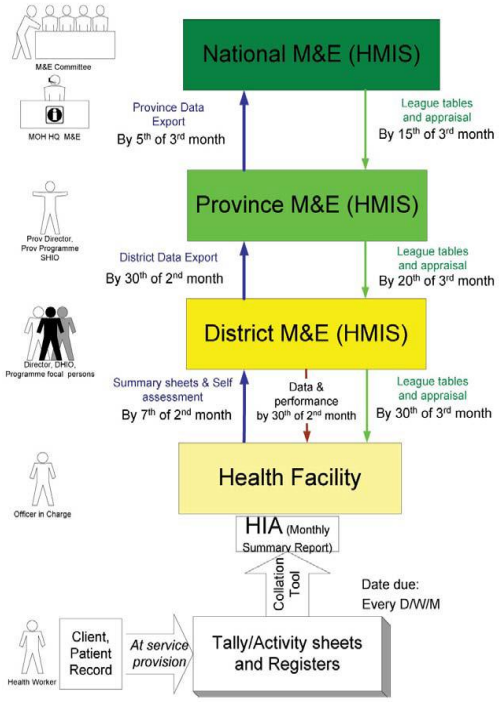

Figure 1 Movement of HMIS data

Understanding incidence trends across the nation is critical to aiding the NMCP. As such, we describe national and provincial malaria incidence for 2013-2015, highlighting vulnerable populations, and comparing proportions of laboratory-confirmed malaria cases reported from Zambia's ten provinces. Our intent is to assess the current trends in malaria incidence and assist policy makers in decision-making around malaria prevention and treatment priorities.

Method

We conducted a descriptive epidemiological analysis of secondary data for all ten provinces of Zambia, i.e. Central, Copperbelt, Eastern, Southern, Luapula, Lusaka, Muchinga, North-western, Western and Northern Provinces.

We extracted provincial data on all malaria cases (clinical and laboratory-confirmed) reported in the Health Management Information System (HMIS) from 2013-2015. HMIS is a routine web-based health information system which was established in 1996 [2]. Its aim is to supply each level of the health sector (facility, district, provincial-level, and national-level) with necessary information in a timely and accurate manner to support informed decision-making. The HMIS covers routine service activities and integrates epidemiological surveillance in every facility within the country (Figure 1). HMIS variables of interest included total reported malaria cases, laboratory confirmed malaria cases, and age group-specific rates of malaria incidence in each province.

The Central Statistics Office (CSO) provide catchment population estimates for each

province based on extrapolated 2010 census data: children under 5 years account for 20%, persons 5 years old and above account for 80%, and pregnant women account for 5.4% of the total provincial population [6].

We calculated overall and age group-specific (under 5 years, and 5 years old and above) malaria incidence using the estimated provincial catchment populations as denominators.

Table 1 Malaria Incidence per 1000 Persons (Both Clinical and Laboratory Confirmed) by Age Group in Zambia, 2013 – 2015

Year	Age <5 years			Age ≥5 years			Malaria in Pregnancy			Malaria Incidence		
	Total	Lab-Conf	% lab. conf	Total	Lab-Conf	% lab. conf	Total	Lab-Conf	% lab. conf	Total	Lab-Conf	% lab. conf
2013	824	410	50	271	133	49	90	45	50	386	191	49
2014	808	538	67	302	201	67	103	69	67	409	272	67
2015	643	518	81	252	203	81	83	64	77	335	269	80
3 yrs	756	495	65	275	180	65	92	60	65	376	245	65

Source: HMIS, 2013-2015

Expected pregnancies accounted for 5.4% of the annual total population and were used as a denominator when calculating incidence of pregnant women at risk of getting malaria infection at a given time. Next, we calculated the proportion of reported cases that were laboratory-confirmed by rapid diagnostic test or microscopy. All collected data were checked, cleaned and entered into a computer using Epi-Info software version 7 [24]. Descriptive statistics were used to compare differences in incidence proportions among age groups, place and time period. We also compared our findings with the findings from the Zambia's Malaria Indicator Survey (MIS) of 2015 which is a comprehensive, nationally representative household survey designed to measure progress toward achieving the goals and targets set forth in the National Malaria Strategic Plan 2011–2015 [9].

Ethical Consideration

This is surveillance and program evaluation activity, not human subject research. Only secondary data without personal identification information was used. Permission to conduct the study and use of the malaria morbidity data was obtained from the National Malaria Control Program of the Ministry of Health (MoH). All data extracted were confidentially stored at the end of the study.

Results

Overall, malaria incidence in Zambia was 386 per 1000 in 2013, 409/1000 in 2014, and 335/1000 persons in 2015, with a three year average of 376/1000. Incidence was higher in persons under 5 years age group compared to persons aged 5 years and above. Incidence of laboratory confirmed malaria among pregnant women was 45/1000 in 2013, 69/1000 in 2014, and 64/1000 in 2015. Incidence of laboratory confirmed malaria in pregnancy was 92/1000 with an average of 65% of cases laboratory confirmed over three-year period, 2013-2015 (Table 1). Nationally, percentage of cases that were lab

confirmed increased from an average of 49% in 2013 to 80% in 2015 (Table 1).

Regionally, North-western Province recorded the highest malaria incidence in all three years, with 867/1000 in 2013, 950/1000 in 2014, and 847/1000 persons in 2015, followed by Luapula and Muchinga Provinces. The lowest incidence occurred in Southern Province with 65/1000 in 2013, 100/1000 in 2014, and 26/1000 persons per year in 2015, followed by Lusaka Province (Figure 2).

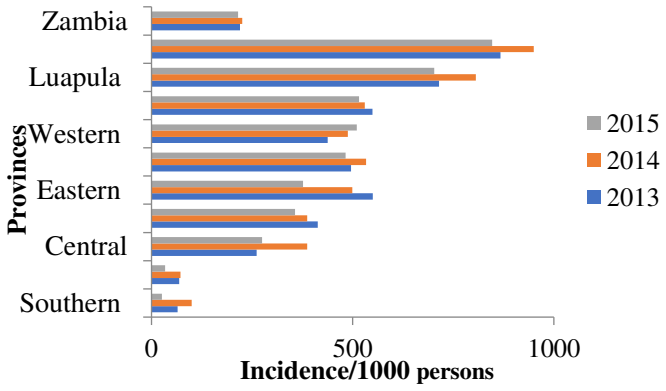

Figure 2 Total Malaria Incidence (Clinical and Laboratory Confirmed) by Province in Zambia, 2013 to 2015

The proportion of cases that were laboratory-confirmed improved over time in all ten provinces. Eighty percent of reported malaria cases were confirmed nationally in 2015, compared with 51% in 2013. The percentage of confirmed malaria ranged among the provinces: from the lowest with only 35% confirmation in Western and Lusaka Provinces in 2013, to 92% in Southern Province in 2015 (Figure 3). During 2013-2015, total malaria incidence was higher among children under 5 years (756/1000) compared to persons aged 5 years and above (275/1000 persons) across all the ten provinces.

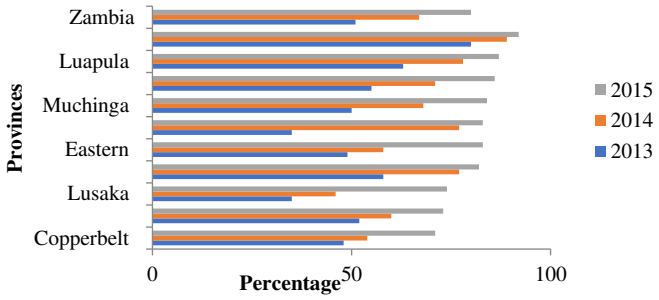

Figure 3 Percentage of Laboratory (RDT/Microscopy) Confirmed Malaria by Province, Zambia, 2013 To 2015

North-western Province recorded the highest malaria incidence among the under 5 age group (1658/1000), followed by Luapula (1600/1000) and Northern Provinces (931/1000) over the 3-year period (Figure 4).

Discussion

This study has important findings regarding the burden of malaria in Zambia. First, the overall incidence of malaria in Zambia increased by 6% between 2013 and 2014, and then decreased by 18% between 2014 and 2015, resulting in an overall decrease of 12% for the 2013-2015 time periods. Notably, the overall incidence is not representative of trends within provinces: substantial variations exist. While a similar increase in incidence from 2013 to 2014 and then drop in 2015 was found in six provinces (Central,

Luapula, Northern, North-western, Lusaka, and Southern), a two-year drop in incidence was found in Copperbelt, Eastern, and Muchinga Provinces. In contrast, a two-year increase in malaria incidence was seen in Western Province. The type of regional variation is seemingly limited to geographic or ecologic influences from local to the national level, implying that strategies put in place were affected differently regionally over the 3-year period.

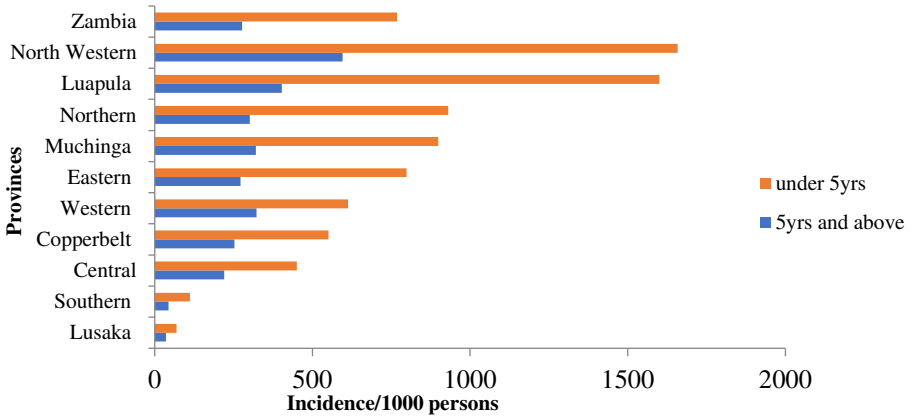

Figure 4 Total Malaria incidence by Age Group by Province over 3 Years, Zambia, 2013 – 2015

Regionally, North-western, followed by Luapula and Muchinga Provinces are at a higher risk of malaria. North-western Province had the highest incidence of malaria during 2013 through 2015 compared to other provinces in Zambia. Suffice to mention is that the proportion of cases that were laboratory confirmed was lowest in North-western province compared to Luapula and Muchinga provinces despite a steady increase recorded across provinces during 2013 to 2015 (Figure3). However, despite having the highest malaria incidence rates overtime, the province recorded a decrease in incidence by 25% in 2015 compared to 2014 (Figure 2). On the other hand, North-western had the highest incidence of malaria in children under 5 compared to other provinces during 2013 to 2015 (Figure 4). Still, these findings indicate a need for concerted efforts to fight the disease in line with the national strategic goal of the malaria control program. While on their way to achieving the strategic framework laid out by the NMCP, this province still requires the involvement of various stakeholders in addition to the MoH, in order to establish effective vector control [7]. Another key finding is that all the ten provinces recorded higher incidence of malaria among children under the age of 5 years compared to persons aged 5 years and above. The highest 3-year incidence in the under 5-year age group occurred in North-western Province followed by Luapula and Northern Provinces. Despite the increase in

malaria disease burden among children under the age of 5 years (as compared to adults), the Ministry of Health with support from partners have through the successive National Malaria Strategic plans been providing free ITNs to the vulnerable population groups which include children under-five years of age to prevent and control the spread of malaria regionally. The malaria strategic plan (NMSP 2011-2016) is to provide, a comprehensive strategic framework for the fight against malaria that contributes to the attainment of the national vision of "a malaria-free Zambia by 2030" [2]. The ITN policy initially targeted young children and pregnant women but has since been extended to cover all age groups through mass distribution campaigns and routine distribution to pregnant women during antenatal care (ANC) clinics so as to increase in ITN ownership and utilization. However, persistently high levels of malaria in Luapula and North-western Provinces may indicate that the existing malaria preventive and control strategies put in place may not have yielded desired results. The deployment of an effective and evidence-based malaria vector control requires locally informed decisions because the epidemiology of the disease varies at a small scale, suggesting the need for precise targeting [8]. The core interventions can be supplemented in specific locations, by larval source management strategies i.e. larviciding or environmental management [13-17]. As such, we suggest that an operational research study to determine risk factors contributing to increased malaria incidence be undertaken in Luapula and North-western Provinces of Zambia. In comparison to the Zambia's Malaria Indicator Survey (MIS) of 2015 [9], Luapula reported the highest level of malaria prevalence, with 32.5% of children's testing slides positive. Muchinga, Northern, and North-western Provinces reported the next highest levels of slide prevalence with 31.4%, 27.6%, and 22.6%, respectively. Lusaka and Southern Provinces reported the lowest levels of slide-positive children with less than 3% positivity. MIS of 2015 indicates that over time, North-western Province has reported a large increase in slide prevalence, from 2012 to 2015 [9]. This finding provides an epidemiologic picture similar to our findings during our investigation period. Additionally, our findings are consistent with some malaria research in Zambia and other sub-Saharan countries, which consistently report higher incidence of malaria among young children

(as compared to adults), and thus there is a need for malaria prevention interventions targeting this vulnerable group [10]. One potential option for achieving improvements in childhood morbidity is by combining ITNs and IRS to improve protection offered by IRS or ITNs alone [11, 12]. Pregnant women are also particularly at risk of malaria, partially due to lowered immunity during pregnancy [18]. Additionally, malaria can have particularly serious health consequences for both pregnant women and their unborn children [3, 19, 20]. As such, the Zambia's MoH has routinely distributed ITNs and provided Intermittent Preventive Treatment in pregnancy (IPTp) for malaria prevention in order to reduce malaria disease burden among pregnant women [18]. This however, does not necessarily mean that malaria incidence among this sub-group will not rise again, because Zambia recorded an increase in incidence of malaria in pregnancy from 90 to 103 per 1000 (from 2013 to 2014) before dropping to 83/1000 in 2015. This finding highlights the need for continued vigilance on protecting pregnant women from malaria, particularly in places with highest incidence, including Luapula, North-western, and Northern Provinces. One of the most definitive findings of this study is the increase in laboratory-confirmed malaria from 2013 to 2015. Nationally, over three-quarters of recorded malaria cases were laboratory-confirmed in 2015, while over half of the cases were laboratory-confirmed in 2013 and 2014. All ten provinces in Zambia had a consistent proportional increase of malaria cases that were laboratory-confirmed over time. With the exception of Copperbelt, Lusaka and North-western Provinces, all other provinces in 2015 recorded >80% of cases confirmed by laboratory test in 2015. The percent confirmed ranged from 35% in Western and Lusaka Provinces in 2013 to 92% in Southern Province in 2015. An increasing proportion of reported malaria cases with laboratory confirmation signifies improved adherence to diagnostic and treatment guidelines of malaria, improved case management, and stronger surveillance. At present, however, some health facilities are still reporting on clinical malaria cases contrary to the diagnostic and treatment guidelines, possibly due to difficulty in obtaining prompt laboratory diagnosis, or inefficient documentation and record keeping of malaria data during period under review. This implies that total malaria being reported may be misclassified [21]. Over-diagnosis can be considerable and contributes to misuse of anti-malarial drugs,

which may yield anti-malarial drug resistance in the general population overtime [21]. Some provinces with higher malaria incidences rates may have less laboratory capacity. As such, continued efforts should be made to ensure that health facilities in the provinces have the tools and skills needed to both confirm malaria diagnosis, and to adhere to diagnostic and treatment guidelines. This will minimize reporting of presumptive clinical malaria cases. Enhanced data audit and verification at both health facility and district levels will further ensure validity of data before being submitted onward to the central reporting system. There are limitations to this study and its findings. This study is ecological, and we could not confirm whether the trends observed represent real changes in malaria incidence versus artificial changes due to reporting. Another limitation is that the HMIS does not disaggregate malaria data by sex, which limited our ability to determine malaria incidence by sex as well as other potential risk factors.

In spite of these limitations, it is clear that malaria incidence in Zambia has substantial variation by province and age group, and possible increases in pregnant women. Continued efforts are needed to achieve the vision of "a malaria-free Zambia by 2030" [2]. This study has identified areas needed for improvement, particularly addressing provinces with high incidence such as North-western and Luapula Provinces, where these findings present an epidemiological picture similar and largely consistent with the results obtained during the Malaria Indicator Survey for 2015 [9]. Future studies should look at seasonal variation of malaria incidence which would require individual-level data that is not available in HMIS. The MoH and partners should rigorously monitor and evaluate the interventions being implemented, and compare their programmatic data to HMIS, in order to ensure that the malaria elimination strategies are well-targeted and coordinated so that substantial results are achieved.

Acknowledgements

This work was funded by the United States Centers for Disease Control and Prevention and the US President's Malaria Initiative. The author acknowledges them with gratitude for supporting and funding the manuscript writing workshop on behalf of the Zambian Field Epidemiology Training Program (FETP). We also acknowledge the role the Ministry of Health is undertaking in coordinating, supporting and ensuring that FETP becomes a success in Zambia. We

would like to thank the following: Dorothy Southern, for providing mentorship and technical skills during training; Nicole Bellows, for providing guidance and mentorship towards the production of this document and Dr. Henry K. Baggett, for reviewing and providing technical advice towards the production of this document. This publication was supported by Cooperative Agreement Number U36OE000002 from the Centers for Disease Control and Prevention and the Association of Schools and Programs of Public Health. The findings and conclusions of this publication do not necessarily represent the official views of CDC or ASPPH.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

Extracted the data: AI, Analyzed the data: AI, RK. Wrote the paper: AI, RK, BH, MM, CFN. All authors read and approved the final manuscript.

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CASE REPORTS

Challenges surrounding the response to road traffic accident emergencies at Ndola Teaching Hospital casualty department, Zambia

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Citation style for this article:
Kopolo J, Mazaba ML, Mulenga D, Siziya S. Challenges surrounding the response to road traffic accident emergencies at Ndola Teaching Hospital casualty department, Zambia. Health Press Zambia Bull. 2017;1(3);[inclusive page numbers].

Availability of appropriate and sufficient medical supplies is essential in saving Road Traffic Accident (RTA) victims. The objective of the study was to establish the challenges in attending to RTA victims that are faced at Ndola Teaching Hospital (NTH), Zambia. A cross sectional study was conducted in which a modified WHO standard for emergency preparedness of health facilities questionnaire was used to obtain data from medical practitioners who had either worked and/or working in the casualty department. Twenty-seven nurses and 8 junior doctors participated in the survey. Out of 35 participants, 24 (68.6%) reported that the emergency (trauma) team was not readily available. The following supplies were reported available and sufficient: gloves (8.6%), splints and roller bandages (14.3%), oxygen cylinders (11.4%), cervical collars (37.1%), ambubag (25.7%), sutures (34.3%), urine bags (0%) and cannulas (62.9%). Eighty percent of the participants reported that stretchers were in bad condition. Generally, basic medical supplies for attending to RTA victims were not readily available. Adequate provision of the basic medical supplies is recommended to save lives.

Introduction

The casualty department stands as a receiving point and often the easiest or even the only access to health care for patients with various challenging needs. The services of the casualty department are available 24 hours a day. Among the cases attended to are Road Traffic Accidents (RTA) emergency cases which require quick and immediate action or else the patient will die or develop serious disability. Patients seeking emergency care can be further harmed because of the failure to deliver emergency care by medical practitioners. Therefore a well-coordinated, prepared and equipped Medical emergency team intervention as early as possible in the

management of severely injured RTA victims would improve the outcome.

The lack of emergency preparedness programs as well as inadequate infrastructure and equipment can lead to death as was observed in the RTA that occurred in Ghana in which all 41 people except one died [1,2]. The incorporation of a trauma team in managing trauma patients has been shown to reduce overall trauma death rates from 6.0% to 4.1% and in those severely injured patients with ISS scores greater than 25, from 30.2 to 22.0% [3]. Data from England and Wales show that the trauma team improved survival in hospitals not recognized as trauma centres [4].

Effective lifesaving management of RTA victims begins with stabilization of the patient and simultaneous assessment of the level of consciousness. The above can only be achieved when there are appropriate and sufficient medical supplies coupled with frequently trained emergency team. Hence, the recommendation by the World health Organization to periodically assess the health facilities' capacity to respond to emergencies [5]. The objective of the study was to establish the challenges in attending to RTA victims that are faced at Ndola Teaching Hospital (NTH), Zambia.

Methods

This was a hospital based cross sectional study done at Ndola Teaching Hospital casualty department. Ndola Teaching Hospital is the second largest referral hospital in Zambia situated in the Copperbelt province in the city of Ndola. A total of 35 questionnaires were distributed to medical practitioners as follows: 27 and eight to nurses and junior doctors, respectively. The inclusion criteria were that those who were working in the casualty department or had worked there before but not more than 2 years ago were requested to participate in the survey. All selected health care workers, included in the study, had worked for at least 12 months in the casualty department. The self-administered questionnaire was distributed and collected between 18th July and 4th August 2016.

The questionnaire solicited for the following information: bed capacity, number of stretchers and their condition, number of personnel per shift, basic medical supplies and their availability (seeking specific responses to whether present and sufficient; never runs out of stock; absent and had not been available in a long time; present but insufficient; frequently runs out of stock and if available does not meet the demand of the

casualty department), presence of emergency team and frequency of life supporting skills training. Data was entered into Microsoft® excel and later exported to the SPSS software version 16.0 for processing and analysis.

Response	Frequency	Percent
<5	5	14.3
5 to 10	21	60.0
>10	9	25.7
Total	35	100.0

The research was approved by the Copperbelt University School of Medicine Public Health Unit and ethical clearance was granted by Tropical Disease Research Centre Ethics Review Committee, NTH management board authorised the research to be done at their institution and verbal consent was obtained from the participants before the interview.

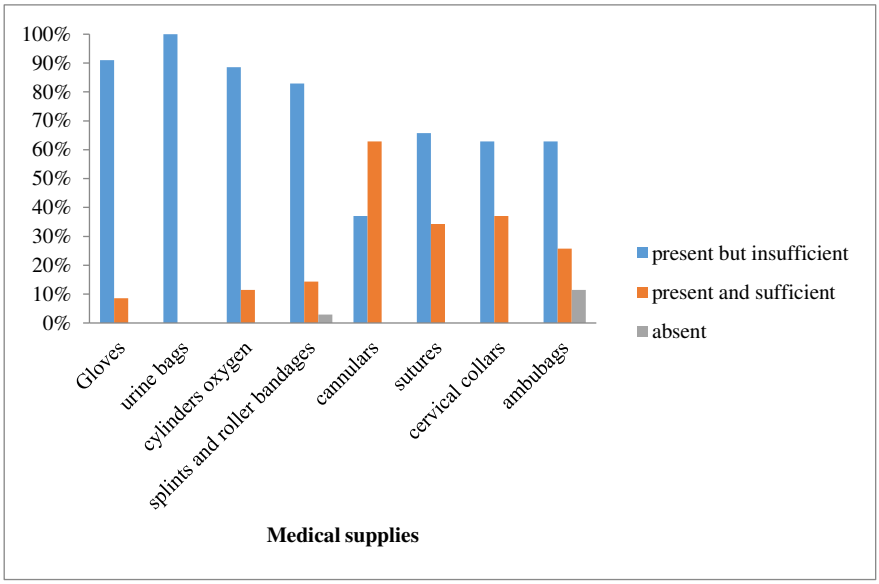

Figure 1 Road traffic accident victims received per day at Ndola Teaching Hospital Casualty department, July – August 2016

Results

Table 1 Road traffic accident victims received per day at Ndola Teaching Hospital Casualty department, July – August 2016

All the 35 medical practitioners who were requested to take part in the survey agreed to do so. Table 1 shows the distribution of the RTA victims received per day with 60% of the respondents indicating that 5-10 victims were received per day. Figure 1 shows availability of basic medical supplies. The following supplies were reported to be present and sufficient: Gloves (8.6%), Splints and roller bandages (14.3%), Oxygen cylinders (11.4%), Cervical collars (37.1%), Ambubag (25.7%), Sutures (34.3%), Urine bags (0%) and Cannulas (62.9%).

Most (94.3%) respondents reported that the department had three stretchers, 2.9% indicated that the facility had two stretchers and 2.9% reported that the facility had four stretchers. On the condition of the stretchers, 80% of the respondents reported that the stretchers were in bad condition (wheels not functioning properly and no stretcher mattresses), while 20% reported that they were in good condition. The bed capacity of the casualty department was 14 beds.

The availability of medical practitioners per shift in the casualty department was as follows: 57.1% of the respondents reported that there was one nurse per shift and 42.9% of the participants stated that there were two nurses. With regards to availability of junior doctors, 62.9% of respondents indicated that there was one junior doctor present per shift,

34.3% reported that there were two junior doctors present per shift and 2.9% indicated that there were three junior doctors per shift. Most (77.1%) of the respondents reported that there was one consultant on call per shift, while 22.9% indicated that there was no consultant. Concerning emergency team availability, most (68.6%) of the participants stated that the team was not readily available (Table 2).

Table 2 Emergency team availability at Ndola Teaching Hospital Casualty department, July – August 2016

Response	Frequency	Percent
Readily available	9	25.7
Not readily available	24	68.6
There is none	2	5.7
Totals	35	100.0

Out of 35 respondents, 27 (77.1%) indicated occurrence of drills and life supporting skills training, while 22.9% reported that drills and life supporting skills trainings occurred only when funds were available. Out of the 27 participants who indicated occurrence of drills and life supporting skills training, 25 (92.6%) responded that they knew drills were taking place but did not witness any.

Regarding other challenges faced by the department; 60% suggested understaffing, 45.7% suggested insufficient medical supplies when attending to emergencies, 51.4% commented on the size and condition of the treatment room as it only accommodated one patient and one staff member and 5.7% commented that senior doctors almost always were never there to assist junior doctors.

The following suggestions were made to address the challenges: about 37.1% of the participants commented that drills and orientations should be done on how to respond to emergency RTA victims, 51.4% recommended that enough medical supplies should be made available to the casualty department, 45.7% suggested that more nurses should be allocated to the casualty department and 42.9% proposed that there was need for a proper and spacious treatment room.

Discussion

Close to 90% of the assessed basic medical supplies were insufficiently available at

Ndola Teaching Hospital casualty department. Results from the current study are in line with the results from a study conducted in Ghana which concluded that many of that nation's hospitals were not prepared to handle large RTA's due to inadequate supplies among other reasons [6].

Close to 80% of the study participants had never seen any training or drill being conducted on how to manage trauma patients, indicating lack of general emergency preparedness programmes and skills for the department. The above-mentioned programmes can improve the coordination and efficiency of the emergency team. It is important to hold frequent drills and refresher courses.

Although it has been shown that involvement of a trauma team for patients with severe injuries (ISS) greater than 12 resulted in significantly better outcomes than patients who received health care on a service-by-service basis [7], trauma teams are rarely available. Trauma teams in the United Kingdom were only available in 20% of the hospitals [8]. Other studies from Australia showed that 56% of adult trauma [9] and 75% of children were taken care of by a trauma team [10].

In conclusion, Ndola Teaching Hospital casualty department is unable to effectively handle large scale RTA emergencies with its current infrastructure, human resources and medical supplies. The emergency/trauma team should be made readily available to attend to emergency cases at the casualty. Periodical basic and advanced life support training and assessments of the emergency team should be conducted. Furthermore, there is need for a spacious and well equipped treatment room and sufficient basic medical supplies to be provided for the casualty department. Further research is recommended to determine the outcome of RTA cases at NCH casualty department.

Acknowledgements

We convey our sincere thanks to Ndola Teaching Hospital management for allowing our team to do this research from their institution. We acknowledge the tireless effort of the sister-in-charge at the casualty department in facilitating data collection

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RESEARCH ARTICLES

Medical prescription pitfalls of acute upper respiratory infections in government health care facilities in Zambia

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Citation style for this article:
Besa C, Siziya S. Medical prescription pitfalls of acute upper respiratory infections in government health care facilities in Zambia. Health Press Zambia Bull. 2017;1(3), [Inclusive page numbers]

Prescribing of medicines is one of the most important clinical task that is complex and consists of a mixture of sub-competences such as principles of clinical pharmacology, knowledge, skill, critical judgement among many others. Prescription errors, potentially serious and non-serious, have been reported in the United Kingdom hospitals among both junior and senior doctors. The aim of this study was to evaluate pitfalls in medical prescriptions of acute upper respiratory tract infection in Zambia. Medical/dental students attended government healthcare facilities and requested for medical prescriptions to enable them purchase medications for their acute upper respiratory tract infection or sore throat. A total of 80 (77.7%) students out of 103 participated in the survey. This study has demonstrated gross drug misuse as all the healthy medical and dental students who presented at government healthcare facilities with complaints of acute upper respiratory tract infection were given medical prescriptions. Only a small proportion of patient's prescription had addresses indicated (16.7%) and not all (87.1%) had patients' names written on the prescriptions. Only a small proportion of prescriptions (28.5%) had generic names indicated on the prescriptions. More than half of prescriptions in this study did not have prescribers' names (54.7%), identification numbers (73.2%) and addresses or departments (71.7%). This study demonstrated over prescription and drug misuse. A large proportion of prescriptions had no identification of both patients and prescribers. Furthermore, only a small proportion of prescriptions were written using generic names making generic substitutions at pharmacy outlets a challenge.

Introduction

Prescribing of medicines is one of the most important clinical task performed by most healthcare professionals including new doctors upon completion of their medical training [1]. Prescription errors, potentially serious and non-serious, have been reported in the United Kingdom (UK) hospitals among both junior and senior doctors [2]. Prescribing errors has made the World Health Organisation (WHO) to produce a six-step model of prescribing to assist prescribers practice safe and effective prescribing [3] rather than simply transcribing. In addition,

a detailed list of prescribing sub-competences than the ones contained in the WHO model has been produced to assist prescribers [1]. Therefore, it is now well recognised that prescribing is a complex clinical practice that consists of a mixture of sub-competences such as principles of clinical pharmacology, knowledge, skill, critical judgement among many others [4].

Many studies in the UK among medical students and foundation year doctors have shown that prescribing is sub-optimal [5-7]. Consequently, educational interventions applying the WHO model have been used and have shown to improve prescribing performance [8,9]. Consequently, the UK has realised that there is need to strengthen clinical pharmacology and therapeutics (CPT) curriculum for tomorrow's doctors training [10]. It is clear that writing a prescription starts from making a diagnosis and not just a matter of simply transcribing as indicated in established prescribing models [1,3].

Until quite recently, there has been only one medical school in Zambia. Presently, there are almost half a dozen medical schools in Zambia including public and private institutions. In addition, there are many foreign trained healthcare professionals practising in both public and private healthcare facilities. Therefore, it is imperative to evaluate prescribing pitfalls in Zambia including the extent of medication errors, polypharmacy, adverse drug reactions, potential drug-drug interactions and common prescription pitfalls. The ministry of health (MoH) has published national guidelines to prescription writing in the Zambia National Formularly (ZNF) [11]. The ZNF is produced to reflect the Zambia National Medicines Policy as a reference document to promote rational prescription. In addition, the ZNF is expected to assist in keeping the cost of medication reasonable, affordable and reduce adverse drug effects.

No study has been done in Zambia, so far, to determine the common pitfalls in medical prescriptions written by medical practitioners. The aim of this study is to evaluate pitfalls in medical prescriptions of acute upper respiratory tract infection in Zambia. Findings from this study will facilitate in design or implementation of educational programs to promote safe and rational prescribing habits in Zambia among medical prescribers.

Methods

This was a cross sectional study conducted between March 2014 and April 2014. As a method of teaching, all the 103 students received 10 copies of the questionnaire to

administer to clients. Clients were conveniently sampled.

Students acted as patients with acute upper respiratory tract infection, sore throat or throat discomfort to the healthcare prescribers at government health facilities in Zambia. On presentation, students asked for a medical prescription to enable them purchase antibiotics from a pharmacy.

The questionnaire that was adapted from the Zambia National Formulary [11] included the following variables on completion of the prescription (legibility, visit date, file number, patient's full name, address, age, gender), dose, dose frequency, duration of treatment, prescription signed and dated, prescriber's characteristics (name, identification number, address), prescription written on official paper and stamped.

Data file was exported to SPSS version 16.0 for analysis. Frequencies were run to describe the sample. The obtained information was transcribed on to a questionnaire and a prescription stored for analysis. Data was computerised using Microsoft Excel version 2007. Frequencies were run to check for out of range errors.

The study was approved by the Basic Science Department as part of teaching during school break. The study was explained to students who freely participated in the study. Students were informed that their none participation will not affect them in any way.

Results

A total of 80 (77.7%) students out of 103 participated in the survey of whom 54 (68.4%) were males. No information on gender was indicated for 1 participant. The median (Q1, Q3) age was 23 (Q1 = 21, Q3 = 28) years. No information on age was obtained from 2 participants. A total of 685 prescriptions were collected.

Table 1 Patient's details

	Prescriptions		
Observations	**Yes n (%)**	**No n (%)**	**Total**
Full name indicated	594 (87.1)	88 (12.9)	682
Address indicated	114 (16.7)	569 (83.3)	683
Age indicated	385 (56.5)	297 (43.5)	682

Over 10% of medical prescriptions did not include patient's name and a large proportion of prescriptions (83.3%) did not have patient's address. In addition, nearly half of prescriptions did not show patient's Most prescriptions were eligible indicating dosage,

Table 2 Prescriptions legibility and content

Observations	Prescriptions		Total
	Yes n (%)	No n (%)	
Legibility	656 (96.0)	27 (4.0)	683
Generic drug name	194 (28.5)	486 (71.5)	680
Drug dosage/dose indicated	673 (98.7)	9 (1.3)	682
Dose frequency indicated	667 (97.8)	15 (2.2)	682
Drug quantity specified	9 (1.3)	672 (98.7)	681
Treatment duration specified	662 (97.1)	20 (2.9)	682
Large blank space left	349 (51.2)	333 (48.8)	682

frequency and duration of treatment. However, only a small proportion of prescriptions (28.5%) had generic names prescribed. In addition, almost half of the prescriptions (51.2%) had large blank spaces left. A large proportion of prescriptions was signed (95.2%) and dated (97.2%). However, only a small proportion of prescription had prescriber's name (45.3%), identification number (26.8%) and address or department (28.3%) indicated.

Discussion

This study has demonstrated gross drug misuse as all the healthy medical and dental students who presented at healthcare facilities with complaints of acute upper respiratory tract infection (URTI) were given medical prescriptions. If the WHO six-step prescribing model had been applied by the prescribers, it would have been clear that there were no clinical signs to support a diagnosis of acute URTI. In addition, anti-microbial drugs are not recommended for acute URTIs, [12]. Therefore, all the prescriptions that were given in this study were inappropriately issued, clearly indicating drug over-prescription and drug misuse by healthcare professionals.

Only a small proportion of patient's prescription had address indicated (16.7%) and only (87.1%) had patient's name written on the prescription. This indicates that a significant proportion of medical prescriptions would not be traced to the affected patients. Medication errors [13] and adverse reactions [14] have been reported to be a growing concern in the UK. The findings from this study has revealed that patients' safety would not be assured in case of prescribing error, as significant proportion of patients would not be traced and advised appropriately.

Table 3 Prescribers' relevant details

Observations	Prescriptions		Total
	Yes n (%)	No n (%)	
Prescription signed	649 (95.2)	33 (4.8)	682
Prescription dated	659 (97.2)	19 (2.8)	678
Prescriber's name indicated	309 (45.3)	373 (54.7)	682
Prescriber's ID number indicated	183 (26.8)	499 (73.2)	682
Prescriber's department indicated	193 (28.3)	489 (71.7)	682

Only a small proportion of prescriptions (28.5%) had generic names indicated on the prescriptions. The implication is that large proportions of prescriptions have brand names making it a challenge to substitute drugs at pharmacy outlets.

A large proportion of prescriptions in this study did not have prescribers' names (54.7%), identification numbers (73.2%) and addresses or departments (71.7%). This observation may have many negative implications such as prescriptions being written by unqualified persons, identification of prescribers in case of drug errors, difficulty to targeted educational programmes to prescribers with prescribing challenges, even in case of medical errors resulting in medical-legal issues.

Being a non-random sample, the results may not be generalised to all clients. However, we have no reason to believe that clients who did not participate were any different from those who participated.

This study demonstrated over prescription and drug misuse. In addition, a number of gross prescribing pitfalls have been highlighted such as poor identification of both patients and prescribers. Furthermore, only a small proportion of prescriptions were written using generic names, making generic substitutions at pharmacy outlets a challenge. In addition, to develop prescriptions monitoring systems should be established to promote safe and rational use of medicines. Furthermore, more research on prescribing practices to be conducted in order to establish relevant gaps in this complex clinical task.

Acknowledgements

We thank the second year medical/dental students of 2013/2014 academic year, of Michael Chilufya Sata, School of Medicine, Copperbelt University, who visited government health facilities with complaints of acute upper respiratory tract infection including sore throat.

Author Contribution

CB conceived the study, participated in the data collection, analysis and interpretation of the results. SS participated in the analysis and analysis of the results. Both authors participated in drafting of the manuscript and agreed its submission for publication

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RESEARCH ARTICLES

Condom use at last sexual intercourse among female teenagers in Zambia: results from the Zambia Demographic and Health Survey, 2013-2014

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Citation style for this article:
Siziya S, Mulenga D, Mazaba ML, Njunju EM, Kwangu M. Condom use at last sexual intercourse among female teenagers in Zambia: results from the Zambia Demographic and Health Survey, 2013-2014. Health Press Zambia Bull. 2017;1(3),[Inclusive page numbers]

Teenager pregnancy is high in Zambia and efforts to curb this vice, including condom use, have had little success. In order to design interventions to raise condom use prevalence, interventions should be designed based on scientific evidence. The objective of the study was to determine correlates for condom use at last sexual intercourse among female teenagers aged 15-19 years. The Zambia Demographic and Health Survey of 2013-2014 data were used in the study to produce nationally representative results. Logistic regression analyses were conducted to determine correlates for condom use. A total of 1485 sexually active female teenagers of age 15–19 years participated in the survey. About a third were of age 19 years (32.7%) and were resident in urban areas (34.6%); 54.6% had attained secondary or higher level and 54.6% never been married. Out of 1485 teenagers who were sexually active, 403 (24.4%) used a condom in their most recent sexual intercourse. Age, province, residence and marital status were independently associated with condom use. Teenagers of age 17 were 37% (AOR = 0.63, 95% CI [0.45, 0.89]) less likely to use a condom compared to older teenagers of age 19 years. Compared to teenagers in Western province, while teenagers in Central province were 71% (AOR = 1.71, 95% CI [1.09, 2.71]) more likely to use a condom, those in Northern Province were 64% (AOR = 0.36, 95% CI [0.16, 0.79]) less likely to use a condom. Participants in urban areas were 1.38 (95% CI [1.15, 1.67]) times more likely to use a condom compared to their counterparts in rural areas. Teenagers who were never married were 1.88 (95% CI [1.55, 2.27]) times more likely to use condom compared to teenagers who were married, cohabited or once married. Sex partners of age less than 20 years were more likely to use a condom compared with sex partners aged 25 years or older (AOR = 1.51, 95% CI [1.08, 2.12]). Interventions to increase condom use rates should be targeted to female teenagers in rural areas, provinces with low condom uptake and female teenagers who are married, cohabiting or once married to delay child bearing in the process.

Introduction

Zambia has placed considerable attention on adolescent's sexual behaviour and how risky sexual activities contribute to poor reproductive and sexual health outcomes

including unwanted pregnancies, abortions, Sexually Transmitted Infections (STIs) and HIV/AIDS. Teenagers tend to have high levels of knowledge regarding HIV and other sexually transmitted infections, yet are less informed on how to prevent infection. Since knowledge alone does not reduce risky sexual behavior [1], it is important to explore risk reduction strategies. Condom use is one of the two most widely publicized risk reduction strategies for HIV transmission [2], the other being number of sexual partners. It is believed that under almost all conditions of prevalence and infectivity, consistent and careful condom use is a far more effective method of reducing the risk of HIV infection. In Zambia, despite campaigns on early marriages and pregnancy, 23.3% of 15-19-year-olds had given birth before 2014 [3]. There is little evidence based statistics and policy guidelines on this issue. Teenage pregnancy is one of the main reasons for school drop outs in Zambia and this consequently leads to reduced opportunities in life for both the teenage mother and her unborn child.

Decision to use a condom is complex. Studies in family planning indicate that decisions not to use protection during sex may be based on insufficient knowledge and distorted judgments of the risks of acquiring sexually transmitted infections and becoming pregnant [4]. In Cameroon, a study on determinants of having ever used condom and current condom use among young people reviewed that relationships exist between higher levels of condom use and parental support, personal risk perception and self-efficacy [5]. A systematic review on intervention impact on condom use in sub-Saharan Africa and Asia showed that in casual relationships, low condom use is a common practice unless one partner was knowingly HIV-infected or at high-risk or avoiding pregnancy. Another study in Australian university indicated that students with self-perception of being at greatest risk of infection were least likely to use condom and it was further noted that, condom use was not related to peer norms [1].

Figure 1 Map of Zambia showing its provinces and neighbouring countries. Source: http://www.zambiaflora.com/speciesdata/about.php

Research on condom use among female teenagers have either been on school-based populations or conducted in a selected district or included in the 15-24 or 18-24 years' age groups. These populations were not representative of female teenagers in Zambia. The current study is aimed at establishing correlates for condom use among female teenagers aged 15-19 years in Zambia. It is focusing on encouraging additional research and interventions aimed at eroticizing condoms among sexually active female teenagers. The study is intended to bring out information that will be a basis for an increase in level of sexual communication and further encourage female teenagers to adopt risk-reduction practices to protect themselves from unwanted pregnancies, sexually transmitted infections and human immunodeficiency virus (HIV).

Methods

Zambia (Figure 1) has a population of 13,092,666 over an area of 752,612 square kilometers; a population density of 17.4 persons per square kilometer and 39.5% of the population of Zambia live in urban areas with the Lusaka and Copperbelt most urbanized provinces being the most populated provinces with Lusaka having 100.1 persons per square kilometers [6]. Lusaka and the Copperbelt provinces are among the ten provinces of Zambia. The geographical structure of Zambia is such that each province is made up of 74 districts, 150 constituencies make up a district, 1,430 wards make up a district, 8,196 Census Supervisory Areas (CSAs) make up a ward and 25,632 Standard Enumeration Areas (SEAs) make up a CSA [6]. A SEA has on average 110 households with 510 people.

The 2013-14 Zambia Demographic and Health Survey [3] was a nationally representative sample. Details of the methodology that was used in the ZDHS 2013-2014 has been reported before [3]. Briefly, totals of 305 SEAs in urban areas and 417 in rural areas were selected. From each SEA, 25 households were selected. Altogether, 18,050 residential households were to be selected nationally: 7,625 in urban areas and 10,425 in rural areas; resulting in 16,516 women (8,356 in urban areas and 8,160 in rural areas) to be interviewed in the 15-49 years age group.

A list of SEAs obtained from the 2010 census was used as the sampling frame for the 2013-2014 ZDHS. A two-stage stratified sampling was used to draw the sample. Each province was stratified into urban and rural areas, giving a total of 20 sampling strata. In the first stage of sampling, 722 SEAs were

selected with probability proportional to the SEA size. Selected SEAs with more than 300 households were segmented. Only one segment was selected for the survey with probability proportional to the segment size. A cluster was thus either a SEA or a segment of a SEA. In the second stage of selection, a systematic sample of 25 households per cluster was selected. All women in the 15-49 years age group who were usual members of the selected households or who spent the night before the survey in the selected households were eligible for the individual interview. The survey resulted in 16,411 interviews of women aged 15-49 years, giving household response rates of 93% and 88% in urban and rural areas, respectively and individual response rates of 96% and 97% in urban and rural areas, respectively. We, however, abstracted data for females aged 15-19 years who were sexually active.

Data were obtained from Demographic and Health Survey [7]. Data analyses were weighted to adjust for differing individual response rates in each sampling stratum. SPSS version 16 was used to analyse the data. Frequencies were obtained to describe the sample. Association between exposure factors and condom use were established using logistic regression analyses. Crude odds ratios and adjusted odds ratios were computed together with their 95% confidence intervals. All the significant factors at the 5% significant level in bivariate logistic regression analyses were considered in a

Table 1 Socio-demographic characteristics of sexually active female teenagers aged 15–19 years in Zambia, 2013-2014 (Total = 1, 485)

Characteristics	n[1] (%)[2]
Age (years)	
15	136 (8.2)
16	222 (14.2)
17	272 (17.4)
18	399 (27.5)
19	456 (32.7)
Province	
Central	124 (9.6)
Copperbelt	109 (11.3)
Eastern	209 (14.8)
Luapula	106 (5.6)
Lusaka	146 (15.7)
Muchinga	96 (4.3)
Northern	136 (7.1)
North-Western	193 (6.0)
Southern	179 (16.4)
Western	189 (9.2)
Residence	
Urban	601 (34.6)
Rural	884 (65.4)
Highest Education Level Attained	
Up to primary	721 (49.3)
Secondary or higher	762 (50.7)
Religion	
Catholic	261 (17.9)
None Catholic	1220 (82.1)
Marital status	
Never married	884 (54.6)
Married, cohabiting or once married	601 (45.4)
Wealth Index	
Poorest	292 (20.7)
Poorer	312 (21.5)
Middle	378 (23.2)
Richer	329 (22.6)
Richest	174 (12.0)

[1]Unweighted frequency; [2]Weighted frequency

multivariate logistic regression. Backward LR stepwise variable selection method was used to enter variables in the model. Probabilities for Stepwise entry and removal were 5% and 6%, respectively.

Table 2 Factors associated with condom use at last sexual intercourse among female teenagers aged 15-19 years in Zambia (2013-2014) in bivariate logistic regression analyses

Factor	COR[1] (95% CI[2])
Age (years)	
15	1.40 (1.01, 1.94)
16	1.50 (1.16, 1.95)
17	0.81 (0.62, 1.06)
18	0.93 (0.74, 1.15)
19	1
Province	
Central	1.16 (0.80, 1.68)
Copperbelt	1.62 (1.16, 2.25)
Eastern	1.00 (0.73, 1.39)
Luapula	0.87 (0.53, 1.45)
Lusaka	1.11 (0.81, 1.50)
Muchinga	0.58 (0.30, 1.11)
Northern	0.38 (0.21, 0.69)
North-Western	1.37 (0.88, 2.14)
Southern	1.00 (0.73, 1.36)
Western	1
Residence	
Urban	1.30 (1.15, 1.47)
Rural	1
Highest Education Level Attained	
Up to primary	0.78 (0.69, 0.88)
Secondary or higher	1
Religion	
Catholic	1.04 (0.89, 1.22)
Non-catholic	1
Marital status	
Never married	2.30 (1.98, 2.66)
Married, cohabiting or once married	1
Wealth Index	
Poorest	0.69 (0.53, 0.89)
Poorer	0.66 (0.51, 0.85)
Middle	0.99 (0.78, 1.24)
Richer	1.26 (1.01, 1.58)
Richest	1
Knows that always using a condom reduces risk of getting HIV	
Yes	1.11 (0.94, 1.31)

No or don't know	1
Alcohol consumption at recent sexual intercourse	
Yes	0.98 (0.80, 1.21)
No	1
Total lifetime number of sex partners	
1	0.93 (0.79, 1.10)
2	0.97 (0.80, 1.18)
3+	1

[1]Adjusted Odds Ratio; [2]Confidence interval

Table 3 Heads of households' characteristics and age of sex partner associated with condom use at last sexual intercourse among female teenagers aged 15-19 years in Zambia (2013-2014) in bivariate analyses

Factor	COR[1] (95% CI[2])
Age of sex partner in most recent sexual intercourse (years)	
<20	2.06 (1.57, 2.70)
20–24	0.82 (0.64, 1.06)
25+	1
Age of head of household	
15–29	0.47 (0.37, 0.61)
30–39	1.46 (1.14, 1.86)
40–49	1.05 (0.84, 1.31)
50–59	1.05 (0.81, 1.35)
60+	1
Gender of head of household	
Male	0.84 (0.74, 0.96)
Female	1

[1]Adjusted Odds Ratio; [2]Confidence interval

Results

A total of 1485 participants in a ZDHS 2013–2014 were sexually active female teenagers of age 15–19 years. About a third were of age 19 years (32.7%) and resided in urban areas (34.6%). Close to 1 in 2 of the respondents had attained secondary or higher level of education (50.7%) and had never been married (54.6%). Altogether, 42.2% of the teenagers belonged to poorer or poorest wealth categories. Further description of the sample is shown in Table 1.

Out of 1485 female teenagers who were sexually active, 403 (24.4%) used a condom in their most recent sexual intercourse. Tables 2 and 3 show factors associated with condom use at the most recent sexual intercourse. All the factors except religion, knowing that always using a condom reduces risk of getting HIV, alcohol consumption at most recent sexual intercourse and total lifetime number of sexual partners were significantly associated with condom use at most recent sexual intercourse in bivariate analyses.

Results of multivariate analysis are shown in Table 4. Teenagers of age 17 were 37% (AOR = 0.63, 95% CI [0.45, 0.89]) less likely to use a condom at most recent sexual intercourse compared to older teenagers of age 19 years. Compared to teenagers in Western province, while teenagers in Central province were 71% (AOR = 1.71, 95% CI [1.09, 2.71]) more likely to use a condom, those in Northern Province were 64% (AOR = 0.36, 95% CI [0.16, 0.79]) less likely to use a condom at most recent sexual intercourse. Participants in urban areas were 1.38 (95% CI [1.15, 1.67]) times more likely to use a condom at most recent sexual intercourse

Table 4 Factors associated with condom use at last sexual intercourse among female teenagers aged 15-19 years in Zambia (2013-2014) in multivariate logistic regression analysis

Factor	AOR[1] (95% CI)[2]
Age (years)	
15	0.87 (0.57, 1.34)
16	1.37 (0.99, 1.89)
17	0.63 (0.45, 0.89)
18	1.23 (0.92, 1.64)
19	1
Province	
Central	1.71 (1.09, 2.71)
Copperbelt	1.35 (0.86, 2.12)
Eastern	1.28 (0.84, 1.94)
Luapula	0.75 (0.38, 1.51)
Lusaka	0.88 (0.58, 1.34)
Muchinga	0.74 (0.33, 1.67)
Northern	0.36 (0.16, 0.79)
North-Western	1.05 (0.60, 1.85)
Southern	1.03 (0.70, 1.50)
Western	1
Residence	
Urban	1.38 (1.15, 1.67)
Rural	1
Marital status	
Never married	1.88 (1.55, 2.27)
Married, cohabitation or once married	1
Age of most recent sexual partner (years)	
<20	1.51 (1.08, 2.12)
20-24	0.79 (0.60, 1.04)
25+	1

[1]Adjusted Odds Ratio; [2]Confidence interval

compared to their counterparts in rural areas. Teenagers who were never married were 1.88 (95% CI [1.55, 2.27]) times more likely to use condom at most recent sexual intercourse compared to teenagers who were married, cohabited or once married. Sex partners of age less than 20 years were more likely to use a condom at most recent sexual intercourse compared with sex partners aged 25 years or older (AOR = 1.51, 95% CI [1.08, 2.12]).

Discussion

Socio-demographic factors (age, province, residence and marital status) were the main determinants for condom use at last sexual intercourse in the current study. The study found that age of the teenager was significantly associated with condom use at first sexual intercourse. The 17 years old teenagers were less likely to use condoms at first sexual intercourse compared to those aged 19 years. Teenagers aged 17 may have been in a relationship for a short period of time compared to the 19-year-old teenagers, this reasoning conforms to the findings elsewhere which indicate that adolescents who have been in relationship for shorter period are less likely to use a condom at the first sexual intercourse [8]. It's also true that at 17 years, teenagers are less informed about preventive measures. Zelnik et al [9] argued that for most young men and women, the initiation of sex seems to be a spur-of-the moment decision and that the majority of them do not plan and so many of them especially teenage women depend upon their partners to use either a condom or withdrawal.

Teenagers in Central province were more likely to use condoms at first sexual intercourse while teenagers in Northern Province were less likely to use condoms at their first sexual intercourse. This could be explained by differences in levels of sensitization on condom use in different provinces. The Catholic religion has a large following in Northern Province. Catholic faith is against use of condoms and this may explain why teenagers were less likely to use condoms at first sexual intercourse in Northern Province compared to the other provinces. Agha et al [10] found that young women affiliated to conservative religious groups were more likely to delay sexual initiation but less likely to use condoms during first sex. It is not clear why teenagers in Central province were more likely to use a condom compared to teenagers in Western province.

Teenagers in urban areas were more likely to use condoms on first sexual intercourse compared to rural areas. This could be explained by the levels of literacy levels that

are high in urban areas compared to rural areas in Zambia [6]. A study done in Lusaka, Zambia showed that consistent use of condoms and lower levels of sexual activities were associated with school attendance and knowledge of AIDS [11].

Teenagers who reported never been married were more likely to use condoms at their first sexual intercourse compared to the married teenagers [12]; this agrees with the findings in Malawi which indicate that condom use is not common in marriage. Never married teenagers may have been more concerned about unwanted pregnancies, HIV and other sexually transmitted infections and this could have made them to opt for condom compared to married/cohabitation/once married.

The age of the teenager's partner was also significantly associated with the likeliness to use a condom. Teenagers with partners aged less than 20 years (in the same 15-19 years age group) were more likely to use condoms. Females might have more sexual relationship power to negotiate condom use if they are of the same age as sex partner and more so if they are older. Older sex partners are more likely to have increased sexual relationship power, self-esteem, and self-efficacy to use condoms [13]. In another study, it was indicated that gender differences play a role on the determination to use condoms despite a partner's objections and the difficulty to use condoms in moments of passion [1].

The study was designed to produce a nationally representative sample for females aged 15-49 years. We nested our study in this sample. We believe that the sample in our study will represent all females aged 15-19 years in the nation. We are unable to generalize findings in the current study to other countries because other countries may have different demographic patterns as well as possible correlates for condom use. In conclusion, interventions to increase condom use rates should be targeted to female teenagers in rural areas, provinces with low condom uptake and female teenagers who are married, cohabiting or once married to delay child bearing in the process.

Acknowledgement

SS obtained the data from DHS, analyzed it and participated in the interpretation and drafting of the manuscript. DM drafted the Introduction and Discussion sections of the manuscript. MLM conceived the study, interpreted the results and participated in the drafting of the manuscript. EMN and MK participated in the interpretation of the results and drafting of the manuscript. All authors approved the final version of the manuscript to be submitted for publication.

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