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EDITORIAL

Teenage Pregnancy – A thorny sexual and reproductive health issue of public health concern

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Sexual and reproductive health continue to be a challenge despite increased attention to them. Maternal and prenatal health are health concerns, especially among pregnant and parenting teens. Although it remains a controversial debate, some studies have shown significantly higher incidence of premature birth, low birthweight, eclampsia, puerperal infection, still birth, and early neonatal death among adolescent mothers [1-3].

The United Nations Population Fund (UNFPA) states that pregnancies among girls aged <18 years can have irreparable harms, violating the rights of girls with life-threatening consequences in terms of sexual and reproductive health such as complications of birth, malnutrition, general ill health, and in some cases death, especially in low-income countries [4,5]. Before the 21st century, teenage pregnancies were normal in developed and developing countries [6]. There has been a general worldwide decrease in teenage (15–19 years) pregnancy from close to 90 births per 1,000 in 1960 to <45 per 1,000 in 2015 [7], however, teenage pregnancy continues to be a disproportionate threat to sexual and reproductive health among adolescents [8]. The United Nations Population Division reports a steady but not uniform decrease among different socioeconomic populations between 1960 and 2015 among teenagers aged 15-19 years: 46 to 13 per 1,000 in high income countries, 96 to 40 per 1,000 in middle income countries, and 137 to 96 in low income countries. Globally, the rates of teenage pregnancy range from as high as 143 per 1,000 in some sub-Saharan countries to 2.9 per 1,000 in South Korea. The World Health

Organisation (WHO) and the UNFPA report in 2013 indicated that about 16 million girls aged 15-19 years, most from low and medium income countries, give birth each year [4]. Sub-Saharan Africa records the highest rate of teenage pregnancy in the world [5, 9], with an overall rate of 100 per 1,000 births among girls aged 15-19 years in 2015 [7].

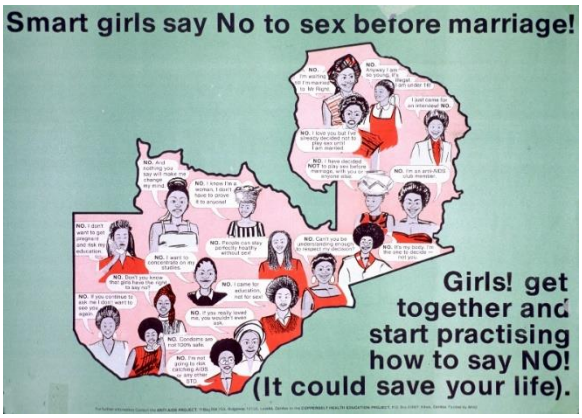
Table 1. Teenagers who had begun childbearing in the Zambia Demographic Health Surveys 2001/02 – 2013/14 (percentage by age)

	Survey year		
Age (years)	**2001/02**	**2007**	**2013/14**
15	4.5	5.8	4.9
16	15.0	16.2	11.9
17	33.8	28.7	25.7
18	44.2	41.0	41.7
19	56.9	54.3	58.9
Overall	31.6	27.9	29.0

The United States in 2011 recorded the highest teenage pregnancy rates, 57 per 1,000 adolescents among the developed countries worldwide followed by New Zealand at 51 per 1,000 and England and Wales with 47 per 1,000 compared to the lowest in Switzerland 8 per 1,000, followed by the Netherlands, Singapore and Slovenia with 14 per 1,000 each [10]. Europe since 1970 has seen an overall decreasing trend in total fertility rate with an increase in the median age of mothers giving birth for the first time. Most western European countries continue to record very low teenage birth rates [11]. Asia overall continues to record high rates of teenage pregnancy, however, in the highly-industrialised countries of the region including Korea and Singapore, teenage birth rates are among the lowest in the world [12]. In Zambia, teenage birth rates remain high. According to the Zambia Demographic Health Survey (ZDHS) reports, 31.6% of girls aged 15-19 years had already had a birth or were pregnant with their first child 2001/02 compared with 27.9% in 2007 and 29.0% in 2013/14 (Table 1). In all the above surveys we see close to and above 5% of 15-year-olds have begun childbearing (4.5%, 5.8%, and 4.9 % in 2001/02, 2007, and 2013/14, respectively). The rates are even higher among the 19-year-olds at 56.8%, 54.3%, and 58.9% [13-15] as shown in table 1.

The persistent birth rates greater than 4% have been attributed to various factors including early marriage, poverty, and low education levels. The UNFPA states that girls from poverty stricken or rural areas and uneducated girls everywhere are at greater risk of becoming pregnant than those who are wealthier, from towns or cities, or well-educated. This is evident on a global level with 95% of the world's births to adolescents aged 15 to 19 years taking place in

developing countries [16]. In a study by L'Engle et al., [17], adolescents exposed to sexuality in the media are more likely to engage in sexual activities. Sexual abuse has also been listed as a factor leading to teenage births. In studies conducted in South Africa, 11% to 20% of pregnancies among teenagers are a direct consequence of rape and approximately 60% of teenage mothers had unwanted sexual experiences preceding their pregnancy [18].



Source:http://resource.nlm.nih.gov/101455954

In Zambia, sexual health, sexuality and HIV are still regarded as inappropriate in many areas of the country, especially in rural communities and this could be a contributing factor to the continued high teenage pregnancy rates [19].

Various interventions are employed globally to mitigate the problem of teenage pregnancy, such as sex education, access to birth control [20], and advocacy against child marriages. In the 2011 estimates documented by Sedgh et. al. indicated higher rates in the United States at 57 per 1,000 births among adolescents, however by 2013, they had recorded a historic low with 26.6 births per 1,000 women aged 15–19 [10] attributed to abstinence and effective contraceptive use [21]. The decreased rates of teenage pregnancies in the United States have been attributed to free access to long acting forms of reversible birth control measures along with education [22]. The low birth rates in Western Europe have been linked to effective sex education and high levels of contraceptive use in the Netherlands and Scandinavia, while in Spain and Italy, it is attributed to traditional values and social stigmatisation; both factors are believed to play a part in Switzerland [11]. Developing countries are making efforts to mitigate the problem of teenage pregnancies, however, the programs of reproductive health in place are small scale and not centrally located, hence the slow decline. However, some developing countries have made great strides, such as Sri Lanka, which has a systematic policy framework for teaching about sex in schools [12]. International non-governmental organisations including the International Planned Parenthood Federation and Marie Stopes continue to provide support for contraceptive advice for all including young women around the world [23,24]. Laws

against childhood marriages and improved literacy among females have been seen to help mitigate the problem of teenage pregnancies in countries such as Iran and Indonesia [25].

In Zambia, strategies to support the return of teen mothers and teen brides to school are among the strategies being employed to reduce the high numbers of adolescent pregnancies. Campaigns including pre-marital sexual abstinence or condom use, or both, are being used as strategies towards reducing issues surrounding sexual and reproductive health such as unwanted pregnancies and sexually transmitted infections in Zambia. [19].

In this issue, we publish some reports in the area of sexual and reproductive health including: Does circumcision influence risky sexual behaviour among circumcised sexually active men in Zambia? Evidence from the 2013-14 Zambia Demographic and Health Survey; Condom use at last sexual intercourse among teenagers in Zambia: results from the Zambia Demographic and Health Survey, 2013-2014; Prevalence and factors associated with voluntary medical male circumcision uptake in Ndola, Zambia, 2016: A cross-sectional study among students; and a policy brief entitled Keeping our future generation alive: reinforcing routine HIV testing and treatment among children in Zambia. Other articles published include: Negligible therapeutic effects of enalapril in a 65-year-old black man with essential hypertension; Misdiagnosis of heart failure for amlodipine adverse reaction; and Bacteriological status of shallow well water and practices of users in Chipulukusu Township, Ndola, Zambia.

I hope you enjoy our issue and find it useful. We welcome your comments through the editorial.healthpress@znphi.co.zm.

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CASE REPORT

Misdiagnosis of heart failure for Amlodipine adverse reaction

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This is a case report of misdiagnosis of heart failure for amlodipine related adverse reaction. Amlodipine is a dihydropyridine calcium channel blocker frequently used in drug treatment of essential hypertension. Adverse reactions of calcium channel blockers are well documented yet the attending physician did not recognise ankle oedema as an adverse drug reaction of amlodipine. Instead, a differential diagnosis of heart was made. If the diagnosis of heart failure was maintained, this would have easily led to inappropriate use of multiple drugs and related problems such as non-adherence to treatment, duplication of treatment, additional adverse reactions and drug-drug interactions. This report has demonstrated poor understanding of the basic principles of clinical pharmacology and therapeutics (CPT) by the attending physician that could have threatened patient's safety.

Background

Dihydropyridine calcium channel blockers have long been recognised to cause peripheral oedema including ankle oedema [1,2] that tend to worsen in the evening [3] and particularly in patients taking long term high doses [4]. If misdiagnosis of heart failure is made due to presence of ankle oedema, this would easily lead to inappropriate use of multiple drugs which is commonly known as polypharmacy [5] and related problems such as non-adherence to treatment, duplication of treatment, adverse reactions and drug-drug interactions. A standard definition of polypharmacy is not used [6] and there is no consistent number of drugs that defines it [5]. Alternatively, polypharmacy may be defined as the administration of more medications than are clinically indicated [7].

Case presentation

A 56 year old male patient had been on 10mg amlodipine daily orally for his essential hypertension for 3 months. The patient's

hypertension was successfully controlled but he started to experience swelling of both feet. The swellings were particularly around the ankle joints. Eventually, the patient was unable to wear his shoes. However, the patient had no other clinical complaints to suggest heart failure such as difficulty in breathing, orthopnoea nor easily getting tired. Consequently, the attending physician conducted several clinical investigations such as chest x-ray, 12 lead electrocardiography (ECG) and echo-cardiography on the patient. None of the investigations performed suggested heart failure nor any cardiac pathology.

It was clear that the swelling of the feet were localized to the ankle joint regions of both feet. Upon questioning the patient, he indicated that he was on amlodipine drug treatment. Hence, the ankle swellings were instantly recognised to be associated with amlodipine treatment and the patient was asked to re-visit his physician for review of his drug treatment. The patient had amlodipine withdrawn and ankle oedema resolved completely within 72 hours. However, the patient has had his blood pressure controlled on another calcium channel blocker, nifedipine, using a retard formulation without any untold reactions.

Conclusion

This report has demonstrated poor understanding of the basic principles of clinical pharmacology and therapeutics (CPT) by the attending physician that could have threatened patient's safety. Therefore, teaching and assessment of CPT to undergraduate and postgraduate students in medical schools need to be strengthened so as to promote effective and safe use of drugs in Zambia.

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CASE REPORTS

Negligible therapeutic effects of enalapril in a 65-year-old black man of essential hypertension

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This is a case report of negligible therapeutic effects of enalapril in a patient of essential hypertension for a period of 3 months. Negligible therapeutic effects of enalapril response in this patient was unexpected as patient claimed complete adherence to the treatment regimen and could possibly be attributed to counterfeit medication which is a recognised problem in some developing nations. Eventually, the patient developed dangerously high blood pressure with the systolic pressure above 200 mmHg. The patient was rescued with sublingual nifedipine and later maintained on monotherapy with another calcium channel blocker. This report has demonstrated that when physicians acquire adequate knowledge and skills in clinical pharmacology and therapeutics, they would be able to adjust drug treatment appropriately. In addition, this report has also highlighted the need to investigate factors that may influence poor response to medications.

Background

Angiotensin-converting enzyme inhibitors (ACEIs) such are enalapril are established drugs used to control blood pressure in hypertensive patients [1,2]. It is now established that ACEIs reduce BP in essential hypertensive patients with normal or low renin levels [1]. Poor therapeutic response to enalapril in a 65-year-old patient is rather unexpected especially if a patient claims complete adherence to the treatment regimen. Therefore, poor therapeutic effect to drug treatment could possibly be attributed to counterfeit medication which is a recognised problem in some developing nations [3-5].

Ankle oedema is well recognised adverse reaction of amlodipine medication [6,7] and prompt recognition would ensure appropriate drug use and avoid inappropriate polypharmacy with associated problems such as additional adverse reactions. In case of hypertensive crises, sublingual nifedipine is well documented and commonly used treatment option [8].

Case Presentation

A 65 year old male black hypertensive patient was commenced on monotherapy with enalapril daily dose orally and titrated from 5mg to 20mg once daily over a period of 2 months. The 20 mg enalapril dose was maintained for 1 month but without any clinically significant reduction in blood pressure (BP). Eventually, the patient's blood pressure was dangerously raised particularly the systolic blood pressure (SBP) to above 200 mmHg. The patient also experienced a mild headache and generally felt unwell.

The patient urgently attended a local clinic and was successfully rescued with a sublingual dose of standard nifedipine. Thereafter, the patient was commenced on once daily oral dose of amlodipine that was slowly titrated from 5 mg to 20 mg. At 20 mg dose, the patient noticed ankle oedema that was particularly noticeable in the evening after a day's work. The patient reported the adverse event to his physician who recognised the reaction of ankle oedema to be related to amlodipine medication. Consequently, the dose was reduced and ankle oedema quickly resolved. The patient's BP was adequately controlled on a lower dose of amlodipine monotherapy without experiencing any further adverse effects.

Conclusion

This report has demonstrated that when physicians acquire adequate knowledge and skills in clinical pharmacology and therapeutics, they would be able to adjust drug treatment appropriately in order to optimise drug treatment and minimise unwanted effects. This report has also highlighted the need to investigate factors that may influence poor response to medications. For example, what is the prevalence and distribution pattern of poor quality, counterfeit and substandard, drugs in Zambia? Findings from such research would be important and relevant in promoting effective and safe use of drugs in Zambia.

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RESEARCH ARTICLES

Does circumcision influence risky sexual behaviour among circumcised sexually active men in Zambia? Evidence from the 2013-14 Zambia Demographic and Health Survey

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Low circumcision and high rates of heterosexual acquired HIV infections are among factors that have "influenced" Zambia to adopt, encourage and spearhead Voluntary Medical Male Circumcision (VMMC) as a preventive tool against HIV infection. Circumcision has been portrayed as the single most important "panacea" or "magic bullet" to HIV prevention in some circles of the Zambian society and many African countries. In this respect, this study aimed at answering two questions: Does circumcision influence risky sexual behaviour among circumcised men in Zambia? And; how do socio-economic and demographic characteristics influence such behaviour? Data for men age 15–59 years interviewed during the 2013–14 Zambia Demographic and Health Survey was used. A total of 14773 men were included in the sample. Logistic regression - the odds ratio - was used to assess the association between circumcision on one hand and socio-economic and demographic characteristics as well as risky sexual behaviours on the other hand. Men aged 35-45 and 45-54 were likely to report being circumcised comparatively (OR=0.691, p<0.001; OR=0.761, p<0.047). Men aged 45-54 were more likely to engage in risky sexual behaviour (OR=0.397, p<0.0001). Being married/living with a partner and being formerly married were highly associated with risky sexual behaviour (OR=0.0004, p<0.0001). In terms of wealth quintile, being in the rich bracket is highly associated with engaging in risky sexual behaviour (OR=1.396, p<0.026). Other sexual characteristics such as having two or more non-marital sexual partners was also highly associated with circumcision (OR=0.085, p<0.014). However, paying for sex, taking alcohol before sex and using a condom at last sexual intercourse with non-cohabiting sexual partner were not associated with circumcision status (OR=0.906, p<0.42; OR=0.846, p<0.138 and OR=0.906, p<0.420). There is strong evidence suggesting that men who are circumcised are also having two or more extra non-cohabiting sexual partners. Proponents of VMMC require to up their messages to ensure complete adherence to safe sexual messages, behaviour and practice if transmission of HIV and other STIs is to be halted and reversed.

Introduction

Circumcision has been adopted as an effective model to lower HIV transmission among sexually active men in Zambia and many other African countries. However, the practice is still substantially low while HIV infections due to heterosexual engagements are still high. This situation is among factors that have "prompted" Zambia to adopt, encourage and spearhead Voluntary Medical Male Circumcision (VMMC) to fight HIV infection [1]. Notwithstanding this point,

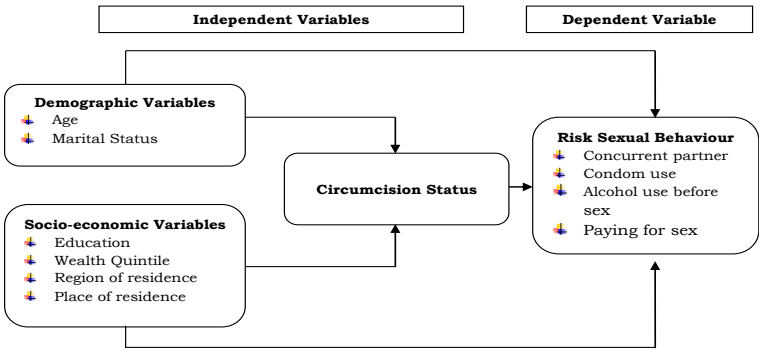

Figure 1 Conceptual Framework

circumcision has been misunderstood substantially and to some extent has also been seen to be a driver of risky sexual encounters. Circumcised men, as it has been debated, seem to be more likely to engage in more risky sexual behaviour due to their circumcision status. However, this evidence is inconclusive especially in the Zambian scenario. Arguments for and against the assertion that circumcision encourages or discourages men to engage in risky sexual behaviour have ensued over time and a number of issues have surfaced.

Evident suggests that uncircumcised men are more likely to get infected with the virus that causes AIDS if they have unprotected sex with women who are infected [2]. However, circumcision has been said to have a protective effect against HIV and other sexually transmitted infections [3, 4, 5]. Notwithstanding this statement, information on the role circumcision plays in protecting circumcised men against STIs including HIV have not gone unchallenged. There are assertions suggesting that, circumcision is, in fact leading men to adopt "careless" and risky sexual behaviours thereby exposing themselves to potential HIV infection [4, 5]. This is so because some circumcised men think that once one is circumcised, one is forever protected [6]. It has also been found that there is complacency in HIV prevention strategies partly due to messages on what circumcision can and cannot do [6]. As a result, some men, even amongst the married, are practicing risky sex such as concurrent multiple relations, inconsistent condom use and transactional sex among others [6].

The question has been: why do circumcised men feel they can engage in risky sexual

behaviour without considering the likely danger associated? This question has been given a lot of attention by a myriad of researchers, and they have come to explain such behaviour with the aid of the Behaviour Risk Compensation Theory (BRCT).

The BRCT proposes that people tend to adjust their behaviour in response to perceived level of risk; usually behaving less cautiously where they feel more protected, and more cautiously where they feel a higher level of risk. In the context of viewing circumcision as a natural condom, the Behaviour Risk Compensation Theory suffices and thereby engendering men to feel less at risk and engage in risky sexual behaviour including non-marital sex, non-condom use, and high number of sexual partners [7, 8, 9, 10]. This may not be the same for uncircumcised men.

However, there is very little or no evidence suggesting how this theory works in practice or giving more insight explaining whether indeed men in Zambia particularly, engage in risky sexual behaviour because they feel "more protected" [11, 12]. In addition, there seems to be no study in Zambia which currently has highlighted and tested whether or not circumcised men "feel" more protected than uncircumcised men and therefore engage in risky sexual behaviour. It is against this background that this paper aimed at investigating whether or not circumcision was influencing risky sexual behaviour among circumcised men in Zambia. Questions this paper aimed to answer were two:

1. Does circumcision influence risky sexual behaviour among circumcised men in Zambia? and;
2. How do socio-economic and demographic characteristics influence risky sexual behaviour given their circumcision status?

Methods

This paper is based on the Zambian DHS of 2014, men dataset. The ZDHS is a onetime cross-sectional retrospective survey conducted every 4-5 years in Zambia. It follows a two-stage stratified cluster sample design, with Enumeration Areas (EAs or clusters) selected during the first stage and households selected during the second stage. In the first stage, 722 EAs (305 in urban areas and 417 in rural areas) were selected with probability proportional to size. Zambia is administratively divided into 10 provinces (Central, Copperbelt, Eastern, Luapula, Lusaka, Muchinga, Northern, North Western, Southern, and Western). Stratification was achieved by separating each province into urban and rural areas.

Table 1 Background Characteristics by circumcision Status

Background characteristics	Circumcision Status (percentages)
Age groups	**Circumcised**
15-24	24.7 [23.0,26.4]
25-34	21.7 [19.9,23.5]
35-44	17.7 [16.1,19.5]
45-54	18.2 [14.3,22.8]
55+	18.2 [14.3,22.8]
Total	**21.5 [20.3,22.9]**
Residence	
Urban	28.5 [26.6,30.5]
Rural	15.7 [14.1,17.4]
Total	**21.6 [20.3,22.9]**
Marital Status	
Never Married	25.4 [23.8,27.2]
Married	18.6 [17.2,20.1]
Former	22.3 [18.7,26.3]
Total	**21.5 [20.3,22.9]**
Education level	
No education	16.4 [12.7,20.9]
Primary	15.9 [14.4,17.5]
Secondary	26.0 [24.4,27.6]
Total	**21.5 [20.3,22.9]**
Region	
Central	12.6 [9.7,16.2]
Copperbelt	31.9 [28.6,35.4]
Eastern	56.5 [54.5,77.6]
Luapula	21.7 [20.0,26.0]
Lusaka	22.9 [20.0,26.3]
Muchinga	8.2 [6.6,10.2]
Northen	7.9 [5.73,10.8]
North-Western	78.2 [69.5,85.1]
Southern	10.8 [8.4,13.8]
Western	46.6 [38.7,54.6]
Total	**21.5 [20.3,22.9]**
Wealth Index	
Poor	16.9 [13.2,17.1]
Middle	15.0 [13.2,17.1]
Rich	27.3 [25.6,29.1]
Total	**21.5 [20.3,22.9]**

As a result, 10 provinces were stratified into 20 sampling strata. In the second stage, a complete list of households served as the sampling frame in the selection of households for enumeration. An average of 25 households was selected in each EA. It was during the second stage of selection that a representative sample of 18,052 households was selected. During the data collection process, trained data collectors performed face-to-face interviews with all eligible men aged 15 to 59 years. Out of the 18,052 households selected, 14773 men were eligible with 13111 being interviewed achieving a response rate of 91.1%. In order to appreciate the analytical process for this paper, a conceptual framework, based on the BRCT was designed as outlined in figure 1. In this conceptual framework, circumcision is both a dependent and an independent variable.

Table 2 Risky sexual behaviour by circumcision status

Risky Sex (percentages)	
Took alcohol before sex	**Circumcised**
Yes	18.7[15.8,21.9]
No	21.8[20.5,23.2]
Paid partner	
Yes	23.9 [20.2,28.0]
No	21.1 [20.1,22.8]
2+ Sex partners past 12 months	
Yes	20.8 [18.6,23.2]
No	21.7 [18.6,23.2]
Total	**21.5 20.3,22.9]**
Had risk sex in past 12 months	
Yes	26.0 [24.0,28.1]]
No	18.3 [16.6,19.8]
Used condom last12 months	
Yes	27.7 [23.5,32.5]
No	18.2 [15.8,20.7]
Total	**20.8 [18.6,23.1]**

In relation to demographic and socio-economic variables, circumcision is dependent. It is also an independent variable since linkages illustrated in by the framework suggest that one's circumcision status

influences their sexual behaviour; which is the gist of this paper.

Table 3 Background characteristics and circumcision status

n=14763			
Background Variables	Odds Ratio	Confidence Interval (95%)	
Age			
15-24	1		
25-34	0.864	0.703	1.062
35-44	0.692	0.553	0.866
45-54	0.761	0.582	0.997
55+	0.756	0.515	1.11
Education			
No Education	1		
Primary	0.924	0.661	1.292
Secondary+	1.197	0.853	1.679
Marital Status			
Never Married	1		
Married/LT[1]	0.937	0.76	1.156
Formerly Married	0.966	0.735	1.269
Province			
Central	1		
Copperbelt	1.987	1.425	2.772
Eastern	0.56	0.397	0.79
Luapula	2.208	1.331	3.663
Lusaka	1.198	0.859	1.669
Muchinga	0.675	0.465	0.981
Northern	0.67	0.428	1.049
N/Western	28.754	16.451	50.258
Southern	0.859	0.586	1.257
Western	7.15	4.585	11.15
Residence			
Urban	1		
Rural	0.615	0.506	0.749
Wealth quintile			
Poor	1		
Middle	0.831	0.696	0.992
Rich	1.389	1.156	1.669

[1]Living with someone as if married

Thus, once circumcised, and based on the aforementioned empirical evidence, these men may engage in risk sexual behaviour because they could be assuming natural protection and immune to the HIV due to circumcision – conforming also to the Behaviour Risk Compensation Theory.

Table 4 Risky sex behaviour and background characteristics

n=11291			
Background Variables	Odds Ratio	Confidence Interval (95%)	
Circumcision status	1.083	0.878	1.336
Age			
15-24	1		
25-34	1.029	0.763	1.389
35-44	0.782	0.575	1.062
45-54	0.398	0.281	0.563
55+	0.324	0.192	0.547
Education			
No Education	1		
Primary	1.244	0.851	1.817
Secondary+	1.366	0.909	2.053
Marital Status			
Never Married	1		
Married/LT[1]	0	0	0.001
Formerly Married	0.016	0.006	0.041
Province			
Central	1		
Copperbelt	0.602	0.412	0.878
Eastern	1.258	0.852	1.859
Luapula	0.496	0.296	0.83
Lusaka	0.814	0.563	1.176
Muchinga	0.494	0.325	0.752
Northern	0.558	0.363	0.857
N/Western	0.741	0.486	1.131
Southern	1.812	1.246	2.634
Western	2.271	1.539	3.353
Residence			
Urban	1		
Rural	1.067	0.833	1.366
Wealth quintile			
Poor	1		
Middle	1.048	0.837	1.313
Rich	1.396	1.04	1.873

[1]Living with someone as if married

The analytical structure included re-coding men as either circumcised (1) or not circumcised (0) at the time of the survey. Circumcision status was first linked to socio-demographic and economic characteristics and thereafter linked to specific risky sexual

behaviour. Socio-demographic and economic characteristics were linked to both the status of being circumcised and identified specific risky sexual behaviours. This analytical approach was necessary to provide specific explanatory modifications associated with the identified risky sexual behaviour on one hand and circumcision on the other hand. The following terms were used to describe "risky sex" in general: *Risky sex* was defined as engaging in concurrent sexual partnerships or multiple on-going partnerships or overlapping partnerships (Zambia Sexual Behaviour Survey 2009); where a man was having two or more steady sex partners other than their "permanent" partner in the last 12 months [14]. *Two plus sexual partners* is where a man had sexual relations or encounters with two or more non-marital/non-cohabiting sexual partners in the last 12 months. *Alcohol intake before sex*; the ZDHS collects data on whether a respondent took or drank alcohol before they engaged in sex. This behaviour is classified "risky" because alcohol consumption is known to influence one's perception of risk and decision making on safe sex [15]. Having taken alcohol before any sexual encounter qualifies to be classified as risky sexual behaviour because of associated judgement errors. *Paid sex*; in this paper, all men who reported to have ever paid for sex were also associated or considered to have engaged in risky sexual behaviour [14].

Table 5 more than two sexual non-marital/cohabiting partners and background characteristics

n=14763			
Background Variables/	Odds Ratio	Confidence Interval (95%)	
Circumcision status	1.193	1.037	1.373
Age			
15-24	1		
25-34	1.663	1.357	2.039
35-44	1.568	1.267	1.941
45-54	1.108	0.867	1.416
55+	0.989	0.684	1.429
Education			
No Education	1		
Primary	1.187	0.897	1.572
Secondary+	1.211	0.901	1.626
Marital Status			
Never Married	1		
Married/LT[1]	1.479	1.207	1.812
Formerly Married	1.242	0.89	1.732
Province			
Central	1		
Copperbelt	0.749	0.549	1.021
Eastern	1.652	1.224	2.231
Luapula	0.773	0.546	1.095
Lusaka	0.905	0.664	1.233
Muchinga	0.967	0.689	1.356
Northern	1.107	0.8	1.53
N/Western	0.774	0.538	1.112
Southern	2.137	1.594	2.865
Western	2.125	1.551	2.913
Residence			
Urban	1		
Rural	1.447	1.224	1.71
Wealth quintile			
Poor	1		
Middle	1.185	1.018	1.38
Rich	1.276	1.036	1.571

[1]Living with someone as if married

Condom use during last sexual intercourse; within the confines of risky sex, condom use was important. In this paper, all men reporting to have engaged in any risky sexual encounters were also asked to state whether

or not they used a condom the last time they had sex with a non-marital or non-cohabiting sexual partner. Bivariate analyses were performed using Stata 13.0 (Stata Corp., College Station, TX, USA) to situate and estimate descriptive relations between the outcome variables and predictor or explanatory variables.

Table 6 Paid sex and background characteristics

n=12688			
Background Variables/	Odds Ratio	Confidence interval (95%)	
Circumcision status	0.906	0.713	1.152
Age			
15-24	1		
25-34	0.972	0.743	1.27
35-44	0.763	0.543	1.071
45-54	0.371	0.22	0.626
55+	0.302	0.114	0.801
Education			
No Education	1		
Primary	1.084	0.636	1.847
Secondary+	0.92	0.518	1.634
Marital Status			
Never Married	1		
Married/LT[1]	0.577	0.42	0.793
Formerly Married	2.429	1.645	3.585
Province			
Central	1		
Copperbelt	0.475	0.305	0.739
Eastern	0.376	0.252	0.56
Luapula	0.74	0.482	1.137
Lusaka	0.663	0.467	0.942
Muchinga	0.401	0.239	0.671
Northern	0.3	0.194	0.463
N/Western	0.977	0.652	1.465
Southern	0.506	0.337	0.761
Western	0.886	0.514	1.529
Residence			
Urban	1		
Rural	0.75	0.565	0.995
Wealth quintile			
Poor	1		
Middle	1.089	0.858	1.383
Rich	0.686	0.486	0.969

[1]Living with someone as if married

Logistic regression models were fitted to the data to model associations between circumcision status and dimensions of background characteristics on one hand and, between circumcision status and identified risky sexual behaviour on the other hand. By adding one explanatory variable after another, it was possible to check how each addition affected the outcome in relation to other variables. In order to check for multi-collinearity among independent variables in the logistic regression, standard errors were examined to observe whether or not they exceeded 2.0 [21]. However, in this study, all independent variables in all adjusted models had a standard error of <2.0, indicating absence of multi-colinearity. Odds ratios (ORs) were estimated to assess the strength of the associations and a 95% confident level and interval (CIs) and a p-value of less than 0.05 were used for significance testing [22]. Due to the complex multistage sampling designs employed in DHS methodologies, a weight variable was calculated and used to accommodate variations in the population.

Results

Table 1 describes study respondents by demographic and socio-economic characteristics and circumcision status. Overall, about two in every ten men are circumcised in Zambia. About a quarter

(24.7%) of the men aged 15-24 years were circumcised. More urban compared to rural men reported to be circumcised (28.5% vs. 15.7%). One in four (25.5%) of the never married were circumcised while only 18.7% of those married were.

Table 7 Alcohol intake before sex and background characteristics

n=14763			
Background Variables/	Odds Ratio	Confidence interval (95%)	
Circumcision status	0.846	0.679	1.055
Age			
15-24	1		
25-34	2.748	2.005	3.766
35-44	3.17	2.168	4.634
45-54	2.914	1.942	4.373
55+	2.71	1.693	4.335
Education			
No Education	1		
Primary	1.234	0.815	1.868
Secondary+	1.13	0.745	1.714
Marital Status			
Never Married	1		
Married/LT*	1.248	0.887	1.755
Formerly Married	2.251	1.487	3.408
Province			
Central	1		
Copperbelt	1.334	1.003	1.775
Eastern	0.599	0.436	0.822
Luapula	0.439	0.31	0.621
Lusaka	1.058	0.768	1.457
Muchinga	1.132	0.838	1.528
Northern	0.804	0.587	1.101
N/Western	0.728	0.489	1.084
Southern	0.564	0.423	0.753
Western	0.568	0.401	0.805
Residence			
Urban	1		
Rural	0.552	0.449	0.678
Wealth quintile			
Poor	1		
Middle	1.044	0.874	1.246
Rich	0.593	0.453	0.777

[1]Living with someone as if married

By education level, men with higher education (26.0%) were reportedly more circumcised compared to those with primary education (15%). Table 2 describes study respondent's risk sexual behaviour by circumcision status. Nineteen (18.7%) of the circumcised men took alcohol before sex compared to (21.9%) among those who did not take. About (23.9%) of the circumcised men paid for sex compared to those (21.0%) who did not. Slightly more than a quarter (26.0%) of circumcised men had risk sex in the twelve months prior the survey. Table 3 shows outcomes of the regression model between background characteristics and circumcision status. The table shows that men who are aged 35-44 and 45-54 were more likely to be circumcised compared to other age groups (OR=0.691, p<0.001; OR=0.761, p<0.047). Education and marital status seem to have no particular statistical significant on circumcision. However, circumcision status was associated with all provinces except Lusaka (OR=1.198, p<0.287) and Southern (OR=0.859, p<0.432) provinces respectively. In the same way, circumcision was also associated with both residence – rural (OR=0.615, p<0.001) as well as the middle wealth quintile (OR=0.831, p<0.041) and rich (OR=1.389, p<0.001). Table 4 shows relationships

between circumcision, risky sex and socio-demographic and economic characteristics. Data in this table suggests that there is no association between being circumcised and engaging in "risky sex". However, after including (adjusting) other variables in the model (background characterises of respondents), there were instances where circumcision was strongly associated with risky sex. For example, circumcised men aged 45 and over were more likely to engage in risky sex compared to other age groups (OR=0.398, p<0.0001 and OR=0.324, p<0.001). Similarly, circumcised married men or those reporting to be living with a partner and those who said they are formerly married were also more likely to indulge in risky sex (OR=0.016, p<0.001). While there are significant associations between circumcision, some provinces and risky sex, there is no association with residence. The table also shows that circumcision status, risky sex and wealth have a significant relationship. Sex with two or more non-marital/non-cohabiting partners is a critical driver for HIV transmission. According to table 5, circumcision was highly associated with having two or more non-marital/non-cohabiting sexual partners (OR=1.193, p=0.014). This phenomenon was more pronounced among men who are between 25-34 and 35-44 years old respectively (OR=1.663, p<0.001; OR=1.568, p<0.001).

Table 8 Condom used last time had sex and background characteristics

n=2280			
Background Variables/	Odds Ratio	Confidence interval (95%)	
Circumcision status	1.251	0.904	1.731
Age			
15-24	1		
25-34	1.295	0.88	1.904
35-44	1.047	0.659	1.664
45-54	0.52	0.278	0.971
55+	0.383	0.136	1.078
Education			
No Education	1		
Primary	1.129	0.627	2.033
Secondary+	1.169	0.621	2.197
Marital Status			
Never Married	1		
Married/LT[1]	0.278	0.19	0.406
Formerly Married	0.703	0.39	1.265
Province			
Central	1		
Copperbelt	0.596	0.342	1.039
Eastern	1.094	0.702	1.707
Luapula	0.336	0.17	0.666
Lusaka	1.009	0.608	1.674
Muchinga	0.694	0.378	1.274
Northern	0.454	0.261	0.791
N/Wester	0.564	0.315	1.008
Southern	0.853	0.542	1.342
Western	1.41	0.808	2.459
Residence			
Urban	1		
Rural	0.65	0.461	0.915
Wealth quintile			
Poor	1		
Middle	0.82	0.6	1.121
Rich	1.053	0.707	1.569

[1]Living with someone as if married

Men who are married and circumcised were also highly likely to have two or more non-marital/non-cohabiting sexual partners compared to those who reported being formerly married (OR=1.479, p<0.001).

Circumcised men from Eastern, Southern and Western provinces seem to be having two or more non-marital/non-cohabiting sexual partners compared to other provinces (OR=1.652, p<0.001, OR=2.137, p<0.001 and OR=2.125, p<0.001 respectively). In the same way, residents of rural areas and men who are in the middle and rich wealth quintiles respectively are highly likely to have two or more non-marital/non-cohabiting sexual partners (OR=1.447, p<0.001; OR=1.185, p=0.029; OR=1.276, p=0.022). Results indicated in table 6 show that there is no significant association between circumcision and paying for sex. However, when background variables are factored in the regression model, the relationship was observed. In this case, table 6 shows that, older circumcised men (45+) were likely to pay for sex compared to other age groups (OR=0.371, p<0.0001; OR=0.302, p<0.016). Data in table 6 also shows that, circumcised married men and those men who reported to be formerly married were paying for sex. In fact, the odds of being circumcised and paying for sex were almost twice as likely for men who reported to be formerly married compared to those who reported to be married (OR=0.577, p<0.001; OR=2.429, p<0.001). By province and residence, it is also evident that a higher proportion of men were paying for sex. In this example, apart from Luapula, North-Western and Western provinces, the rest of men in other provinces paid for sex. What is also evident from data in table 6 is that, men with a middle wealth quintile status were more likely to pay for sex compared to the rich and poor quintile. However, the odds were not statistically significant. On the other hand, a statistically significant relationship existed between being rich and circumcised and paying for sex (OR=0.686, p<0.033). Results in table 7 show that circumcision on its own has little or no effect on the risky behaviour of consuming alcohol before engaging in sex. However, upon introducing background variables in the regression model, results in the table show strong associations between circumcision and taking alcohol before sex. For example, all age categories are highly associated with taking alcohol before sex. Similarly, there is a strong relationship between taking alcohol before sex and a background characteristic of “formerly married”; similarly, circumcised men in rich wealth quintile were also likely to take alcohol before sex (OR=0.593, p<0.001). Consistent and correct condom use is one of the emphatic messages propagated widely by both HIV/STI prevention campaigners and by those advocating for VMMC. This paper

was also anchored on investigating whether or not men who have been circumcised are "practicing" what they have been taught, especially correct and consistent condom use. Table 8 shows results of condom use at last sex encounter with a non-marital/non-cohabiting sexual partner by men who reported to be circumcised. Although the odds of condom use among circumcision is higher, there is no significant relationship between circumcision and condom use at last sex (OR=1.251, p=0.176). In other words, circumcised men who are having sex with non-marital/non-cohabiting sexual partners are not using condoms. After adjusting for background variables in the regression model, it seems clear that there are moderately few instances where circumcision influences condom use. In terms of age, only the age group 45-54 has results suggesting condom use the last time they had sex (OR=0.520, p<0.04). Married men were also more likely to use condoms (OR=0.277, p<0.001). Respondents in Luapula, Northern and North-Western provinces and those residing in rural areas were 0.3 times more to use condoms during the last sexual encounter compared to other provinces and urban (OR=0.336, p<0.002; OR=0.454, p<0.005; OR=0.563, p<0.053; OR=0.649, p<0.014).

Discussion

In summary, results in this paper show that circumcision status, on its own does not influence sexual behaviour as such. The only direct association between circumcision and risky sexual behaviour was only seen among respondents who reported to have had multiple concurrent sexual partners (two plus sexual partners). However, adjusting or factoring into account socio-economic and demographic characteristics in the circumcision equation produced substantial effects on risky sexual behaviour among circumcised sexually active men in Zambia.

VMMC has been well received. One of the main reasons for this acceptance is the evidence suggesting that it reduces the risk of men acquiring HIV through vaginal intercourse [16]. However, while this fact is evident, the question begging answers has been "do men and women understand that circumcision has but partial protection?" and secondly, do they act on the messages to protect themselves from HIV and STI infection after circumcision? [17]. In this paper, the question asked was whether or not circumcision (and messages around it) is influencing risky sexual behaviour among circumcised sexually active men in Zambia.

Messages on circumcision and how circumcision protects or provides partial

protection have been misconstrued by many. For example, study results in different societies seem to suggest that men who are circumcised think they are protected or immune to HIV infection [18]. On the contrary, FHI360 found that almost 100 per cent of all respondents in their 2014 study seemed to understand that circumcision only has but partial protection against HIV infection. The FHI360 study further suggested that there was little evidence about men engaging in riskier sexual behaviour after VMMC. However, while this may have been the case, results in this paper are different.

While there is no strong evidence from the ZDHS 2013-14 data on circumcision and risky sex, adjusting this relationship by socio-demographic characteristics, shows there is. In the same way, circumcision has also particular influence on men having two or more sexual partners. The data shows that the odds of being circumcised and having two or more non-marital/non-cohabiting sexual partners are about 1.19. Going by this finding, messages encouraging men in general and those who are circumcised in particular to "have one faithful sexual partner" emphasised also during circumcision counselling are not having any meaningful effect. This may mean that before men get circumcised, they could be more "faithful" to the counselling, however, after "graduating", common sense and rumour directs more their decisions on sex and sexuality thereby diluting altogether the safety associated with circumcision.

This study went on to explore whether circumcised men were paying for sex and whether they were taking alcohol before indulging in sex. Results suggest that there is no direct relationship between circumcision and paying for sex. However, older circumcised men (45+), residents of rural areas and the rich by the wealth quintile are likely to pay for sex. On the other hand, there is a strong relationship between taking alcohol before sex and circumcision .The message here again is the same; that information on what circumcision is able or not able to do in the fight against HIV seems to be misplaced to give a "false sense of security" where circumcision becomes a "shield" against HIV infection irrespective of the functional state of the person or individual practicing the risky behaviour.

This paper has also provided concrete evidence suggesting that circumcised men are not using condoms during sex with non-marital/non-cohabiting sexual partners. Even after adjusting for other background

variables, very little evidence suggests otherwise.

In the context of VMMC objectives and purpose and also situating such with a view to fight HIV infections, results in this paper are not encouraging for any advocate or supporter of circumcision and the strong, well-intended messages around it. Frankly, positive sexual behaviour change takes long, unless it is painful. In this respect, encouraging positive messaging on what VMMC does and doesn't do is critical to addressing challenges resulting from what has been misconstrued as reasons for VMMC. Although VMMC is well intended and seems to have strong partial protection against HIV and other STIs, findings in this paper show the need to structure messaging that take into account a strong stance against general falsehood on how and what works for the circumcised. In a study in North-Western Province of Zamia on circumcision by Mapoma et all [19], focus group discussion participants unearthed misleading "street" messages that go round on how circumcision gives protection against HIV infection. This definitely is not a reflection of what goes on in the country. However, this is localised evidence of wrongly compounded information on what circumcision does or does not do and may easily be replicated to the whole country. To be belabour the point, one participant said:

"Circumcision provides 60% protection; when you include a condom, this goes up to 100% protection"

Indeed, there is no such a thing as 100% protection; even where 100% abstaining is present, there is chance of infection. However, circumcision is totally being misconstrued to mean "total protection" and messages in communities seem to be highly "polluted" and volatile to the extent of making VMMC a "risky factor" by itself instead of playing the role of protection. This study therefore also highlights further the fact that men are circumcised for various reasons [20]. It could be that they get VMMC so as to avoid condom use; or it may mean getting circumcised so as to have as many sexual partners as possible without worrying about the risk of infection. However, proponents and advocates of VMMC should reiterate that the procedure provides only partial protection against HIV infection and therefore specific additional ways to reduce the risk of HIV infection such as discouraging multiple sexual relationships, encouraging correct and consistent condom use and the like should instead be emphasised.

Clearly, circumcision does have negative effects on risky sexual behaviour. A number of reasons do explain this situation. While there is no concrete base upon which to investigate why men who are circumcised maybe engaging in risky sex, it is possible conclude that substantial amount of misinformation on what circumcision can and cannot is influencing this outcome. Based on these findings, it is important to note that the messaging and counselling that goes on around VMMC should be followed up to a logical conclusion. It should be noted that for behaviour change to ensue and take effect, people getting circumcised must undergo pre and post circumcision with deliberate processes of follow ups in communities to help "safe guard" against "falsehood" which if not corrected would inadvertently expose men to a more heightened risk of getting infected with HIV contrary to intended objectives of VMMC.

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RESEARCH ARTICLES

Bacteriological status of shallow well water and practices of users in Chipulukusu township, Ndola, Zambia

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In many countries in Africa piped water availability is limited and cannot meet the demands of the growing populations. Most rural areas in Africa resort to underground water which is readily available and is believed to be uncontaminated due to its filtering system as it drains back into the ground. However, it is not always the case due to many factors such as overcrowding, poorly constructed pit latrines and humans that contaminate water. A cross sectional study was conducted to determine bacteriological status of shallow well water and practices of users in Chipulukusu township in Ndola, Zambia. Data was collected using a structured questionnaire and water samples were examined for the presence of fecal coliforms. Data was entered in Epi Info version 7 and analyzed using SPSS version 16. A total of 58 (84.1%) out of 69 households participated in the study. Altogether, 53 (91.4%5) wells were unprotected. All respondents stored their water in wide mouth containers. From a total of 58 households, 34 (58.6%) treated their water with chlorine. The distance between the well and pit latrine for 57 (98.3%) out of 58 households was below 30 m. A total of 47 (81.0%) out of 58 wells contained fecal coliforms. The majority of the wells were contaminated with fecal coliform making water unsafe to use and increases the risk of water borne diseases. Boiling and chlorination will make water fit for drinking.

Introduction

In many countries in Africa (including Ethiopia, Nigeria, Serra Leone and Zambia), piped water availability is limited and cannot meet the demands of the growing populations [1-7]. Rural areas in developing countries resort to readily available underground water [8]. Under ground water at most is believed to be uncontaminated due to its filtering system as it drains back into the ground [9]. However, due to overcrowding, no water and sewage utilities and poorly constructed pit latrines, human waste can reach ground water and contaminate it [10,11].

Every rainy season, Zambia experiences outbreaks of cholera, diarrheal and other water borne diseases [12].

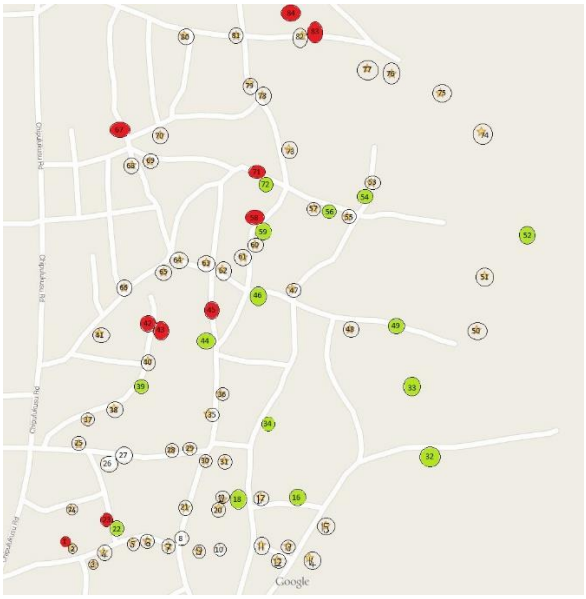

Figure 1 Map of Chipulukusu township showing a population of wells

The majority of households in unplanned settlements and most of the new settlements in Zambia are still not serviced by piped water [3]. Contamination of ground water may occur at different stages during the process from point source, collection and storage of water to consumption [10,13,14]. The risk of micro-organisms contaminating drinking water during collection and storage in the home has previously been reported [1,15,16]. Field investigations carried out in Kitwe, Zambia recognized certain practices and vessel characteristics that are associated with the contamination of household water and diseases resulting after. Use of large-mouth vessels to collect and store water, transferring water from collection vessels to storage vessels and getting water by dipping hand-held utensils rather than via a tap or by pouring have been reported to be associated with contamination of household water [1,17–20]. From the above stated practices, contamination does occur; the open mouth design of the vessel and time from collection to use also favors the survival of the bacteria [21,22].

Chipulukusu is among the largest and fast growing townships in Ndola, having a population of approximately 41,837 with no piped water, sewerage services and utilities [12]. The lack of piped water has made the people of Chipulukusu resort to self-dug shallow wells. These wells are poorly constructed and do not conform to the public health (building and latrine; part xii – provision of latrine accommodation, section 85) regulation Act of the laws of Zambia. There is scanty information on the quality of water at point of collection in Chipulukusu. The aim of the study was, therefore, to determine the biological status of shallow wells and the knowledge, attitudes and practices of users in Chipulukusu in Ndola, Zambia.

Methods

A cross sectional study was carried out from July 2015 to August 2015 in Chipulukusu, Ndola on the Copperbelt province of Zambia. Chipulukusu is situated on latitude 12°57'6.09"S and longitude 28°40'23.58"E at an altitude of 1270 m with a humid sub-tropical climate. The climate of Ndola is characterized by a dry season of 7 months duration from May to October and an average rainfall of 1232.8 mm.

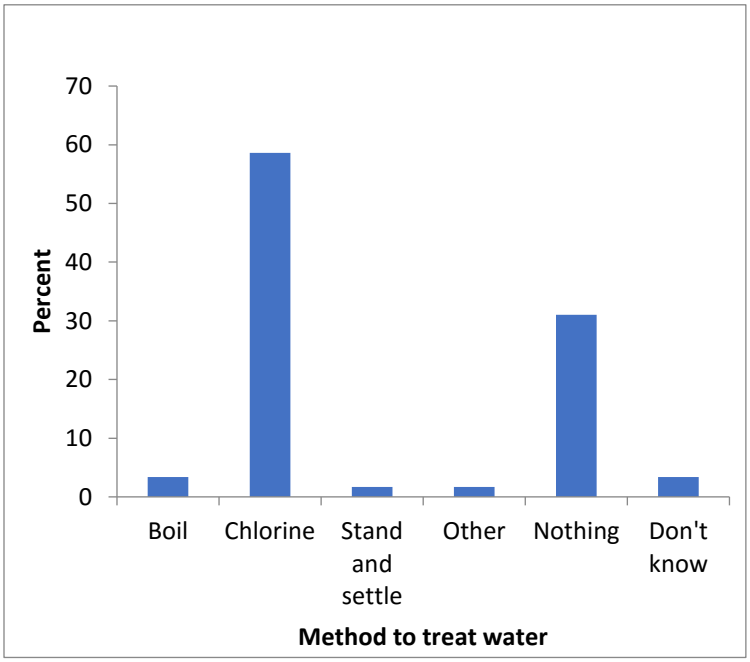

Figure 2 Methods used to treat water

Chipulukusu township is divided into 14 zones based on population distribution and density. The areas of interest were zones exclusively using well water for their consumption or zones not supplied by piped water. From the criteria, zones 3 and 3B were selected as sampling sites. A total of 84 wells were enumerated in the study area and Geo-tagged for easy location and identification. Assuming a rate of contamination of 50+5% (as no estimate was available) and a 95% confidence level, a sample size of 69 wells were to be sampled. Wells were randomly selected using a simple random sampling technique. Figure 1 shows the distributions of wells in the study area. Since the wells were individually owned by households, the oldest person aged 18 years or older found at the household was requested to participate in the survey.

The proposal was reviewed and approved by the Tropical Diseases Research Centre Research Ethical Committee and the Clinical Science Department, Public Health Unit, Michael Chilufya Sata School of Medicine, Copperbelt University, Ndola, Zambia.

A structured questionnaire comprising socio-demographic characteristics and water quality variables was administered to residents. Water was aseptically collected (150 ml) in sterile reusable bottles from each well using a collector (container) for a particular well. These samples were transported to the laboratory in cooler box with ice packs within three hours after collection. By use of membrane filtration techniques, 100 ml of

water was then filtered through the membrane (1.45 µm, 47 mm GN-6 Metricel) connected to a vacuum pump [23]. Filtration was done in triplets, and after every set, all components of the filtering apparatus were sterilized in an ultraviolet chamber for 30 minutes. The membranes were placed on the selective m-FC agar plates then incubated at 44±0.5°C for 24 hours. Coliforms greater than 100 were considered too numerous to count (TNTC). The distance between the wells and the pit latrine was measured as well.

Data collected from the laboratory and questionnaires were entered in Epi info version 7.0 and exported to SPSS version 16.0 for analysis. Correction and editing was done after running the frequencies and checking for out of range responses. Data was summarized using frequencies.

Results

A total of 58 (84.1%) out of 69 households participated in the study. Table 1 shows distributions for socio-demographic factors of the sample. The majority of the participants were aged below 50 years (75.9%), married 38 (65.5%), Protestant by faith 45 (77.6%) and 51.7% had attained primary level of education. In terms of occupation, the majority (46.6%) were traders/businessmen or women with most (96.6%) of the respondents earning an income below the minimum wage of ZMK522.00 (U$D 66.03).

A large proportion of the participants lived as a nuclear family (63.8%) with family size ranging from 2 to 10. The majority (77.6%) of the respondents had lived in the area for less than 25 years.

Table 1 Distributions for socio-demographic factors of the sample

Factor	n (%)
Age (years)	
<50	44 (75.9)
50+	14 (24.1)
Marital status	
Single	14 (24.1)
Married	38 (65.5)
Widowed/widow	6 (10.3)
Religion	
Catholic	8 (13.8)
Protestant	45 (77.6)
Islam	5 (8.6)
Education level attained	
Below primary	10 (17.2)
Primary	30 (51.7)
Secondary	18 (31.0)
Occupation	
Trade/business	27 (46.6)
Housewife/unemployed	22 (37.9)
Retiree	2 (3.4)
Student	3 (5.2)
Other	4 (6.9)
Income (ZMK)	
<522	96 (96.6)
522+	2 (3.4)
Family type	
Nuclear	37 (63.8)
Extended	21 (36.2)
Length of stay (years)	
<25	45 (77.6)
25+	13 (22.4)

Table 2 shows distributions of water and sanitation-related factors. Most (91.4%)

households had unprotected wells and all households stored their water in wide mouth containers.

Table 2 Distributions of water and sanitation-related factors

Factor	n (%)
Source of water	
Protected well	5 (8.6)
Unprotected well	53 (91.4)
Toilet use	
Shared with people outside family	42 (72.4)
Not shared with people outside family	16 (27.6)
Disposal of fecal waste of young children	
Child used latrine	9 (15.5)
Thrown into garbage	7 (12.1)
Buried	31 (53.4)
Left in open	1 (1.7)
Did not know	10 (17.2)

In terms of method of water treatment, 58.6% used chlorine (Figure 2). All respondents used a pit latrine with the majority (72.4%) of the participants indicating that they shared a toilet with anyone in the community. Fecal waste of the youngest children in about half of families (53.4%) was disposed by burying. Almost two thirds (62.1% or 36/58) denied suffering from diarrhea 6 months prior to the interview and 39 (67.2%) of 58 respondents indicated to not have had diarrhea in last 2 month before the study. A total of 47 (81.0%) out of 58 wells contained fecal coliforms. Out of 58 households, 57 (98.3%) had <30 m between the well and pit latrine.

Discussion

The households of Chipulukusu solely depended on pit latrine for the disposal of fecal waste. During rainy seasons, runoff water entered the pit latrines and also contributed to the groundwater contamination. The distance between the well and pit latrine of less than 30 m was observed in most households (81.0%). Thus, contravening the Public Health Act of 1995 which states that the minimum distance between the pit latrine and the nearest well should not be less than 30 meters. The small sizes of the plots contributed to the close proximity of the wells and latrines.

All respondents reported to store water in wide mouth container. These results are similar to the results found in a study done in Samara, Zaria, State Nigeria [7]. It was stated in another study that narrow mouth containers significantly reduced contamination with *E. coli* [1]. Therefore, it was possible that water stored in wide mouth containers was contaminated. The majority of the respondents denied to have suffered from diarrhea in 6 months and 2 months prior to the study. This could be attributed to the high response rate on chlorine usage [3].

The microbiological examination revealed that a large proportion of the wells were contaminated by *E.coli,* indicative of fecal contamination. This could be as a result of the poor means of waste (fecal) disposal, proximity of the pit latrine toilets and the well

and runoff water during the rainy season. This exceeds the guidelines recommended by WHO international standards which state that no sample should contain fecal coliform or *E.coli* and there should be no total coliform/100 ml of water. Other studies conducted in Nigeria showed similar results with well water samples reported to have high MPN value [4].

Most of the wells were contaminated with fecal coliform making water unsafe to use and increased the risk of water borne diseases. Boiling and chlorination remain the best means of treating water.

The study might have had limitations in that the information given by participants might have been biased due to fear of their wells being declared unsafe. In addition, the fecal coliform count, *E.coli* isolation and drug sensitivity were not determined. Furthermore an association between the measured well to pit latrine distance and total fecal coliform count was not determined. These limitations provide prospects for future work.

Acknowledgement

The authors want to put the sincere gratitude to Tropical Diseases Research Centre for laboratory support. The participants are thanked for making the study a success.

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OUTBREAK REPORT

Descriptive characterization of the cholera outbreak In Lusaka District, 2016

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On February 5, 2016, the Zambian Ministry of Health was notified of cholera cases in the western part of Lusaka district, which spread rapidly to peri-urban areas in the northern and eastern part of the city in the subsequent weeks. We conducted a descriptive analysis of the cholera outbreak.

We conducted a retrospective analysis of the line list, obtained through the district surveillance officer. Cholera case definitions were modified integrated disease surveillance response (IDSR) manual. Attack rates (ARs) and case fatality rates (CFRs) were calculated. Population projections from the Central Statistics Office 2010 census were used to generate the ARs. We interviewed confirmed case-patients using a standard questionnaire to get exposure information. Data from laboratory and environmental assessment records were extracted for analysis.

A total of 1,054 cases were reported from 5th February - 31st May 2016 with an overall AR of 45.2 cases/100,000 population and overall CFR of 1.9%. The median age of case-patients was 22 (IQR: 7-32) years and the age-specific CFR was highest among case-patients <5 years (6%). Of those interviewed (n=44), boreholes (64%) were the most common water sources and hand washing with soap was not routinely practiced. About 32% (n=44) of the cases did not treat drinking water, 36% used chlorine, and 27% boiled their drinking water. The circulating strain was *Vibrio cholerae* serogroup 01 Ogawa, biotype El Tor, and was 100% sensitive to ciprofloxacin and chloramphenicol. *Vibrio cholerae* was isolated from 59 water and five food samples

Poor sanitation, inadequate access to clean water, and contaminated foods, were possible contributors to the outbreak. There is need to sensitize the communities on personal hygiene and improve water access.

Introduction

Cholera is an acute intestinal diarrheal disease characterized by profuse watery diarrhea, vomiting, and rapid dehydration. In the absence of adequate treatment, the mortality rate is high; in vulnerable groups and high-risk areas, mortality rates of up to

7.5% have been reported [1]. Modern cholera outbreaks are caused by *Vibrio cholerae* 01 Inaba El Tor and O1 Ogawa biotype El Tor strains [2, 3]. Currently, African countries account for the highest proportion of cholera cases reported worldwide [3].

Table 1 Distribution of Cholera Cases and laboratory results in Lusaka District Feb-May 2016 (N=1,054)

Characteristic	Number (%)
Female	502 (48)
Male	552 (52)
Median age (yrs)	22 (IQR: 7-32)
Age groups (yrs)	
<5	140 (13)
5 – 15	237 (23)
16 – 29	328 (31)
30 – 59	292 (28)
60+	47 (5)
Unknown[1]	10 (1)
Place of residence	
Kanyama	336 (32)
Bauleni	301 (29)
Mandevu	147 (14)
Matero	126 (12)
Munali	66 (6)
Chawama	49 (5)
Kabwata	29 (3)
Laboratory findings (% positivity)	
Stool culture (n=45) Rapid	20 (44)
diagnostic tests (n =125)	90 (72)

[1]Three of the twenty deaths were among individuals with unknown age

Lusaka district has a population of approximately 2.3 million, and has 33 health facilities. Lusaka district is densely populated (100 person per square kilometer) with a large portion of the population living in peri-urban areas, where overcrowding and poor water and sanitation are prevalent, thus increasing the risk of waterborne diseases such as typhoid and cholera [4, 5].

Most cholera outbreaks occur in the western part of Lusaka city, which is a low-income densely populated area with several compounds clustered together. It has insufficient coverage of drainage networks, resulting in flooding during the rainy seasons. The lack of clean water and sanitation facilities are major challenges affecting the communities in this part of the city [5, 6]. Cholera was last recorded in Lusaka during the 2010/2011 rainy season from January to April [4]. An analysis of available rainfall and cholera outbreak data in Lusaka shows a strong association between rainfall and cholera outbreaks [4].

Outbreak

On 5th February 2016, the Lusaka District Medical Office received notification that four members of a single family presented with diarrhea and vomiting at Kanyama public clinic in western Lusaka after the burial of a family member who died of similar symptoms. Rectal swabs collected from all the four patients examined at the Kanyama public clinic yielded *vibrio cholerae* .at the reference laboratory. The Lusaka District Medical Office opened a Cholera Treatment Center (CTC) at Kanyama public clinic was opened on 7th February. As more cases arose, a second CTC was opened at Matero Referral public clinic in the northern part of Lusaka on 8th March 2016, and a third CTC was opened at Bauleni public clinic in the eastern part of

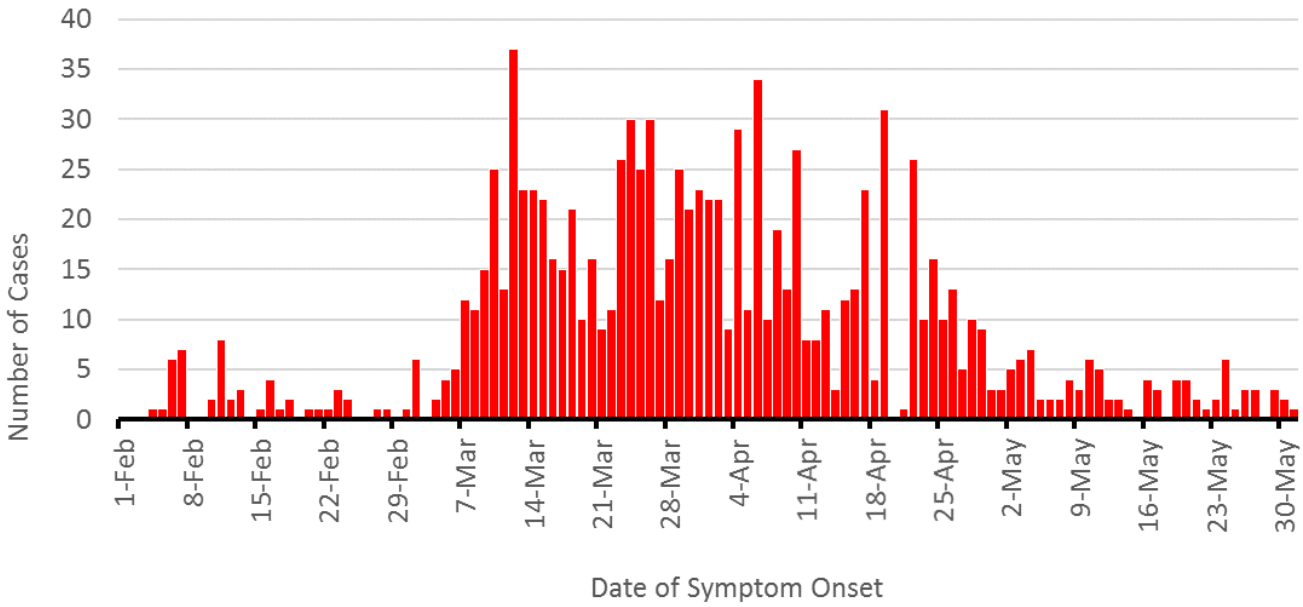

Figure 1 Cholera Epidemic curve, Lusaka District Feb-May 2016 (N=1,054)

Lusaka on 9th March 2016. Each CTCs was staffed with qualified health personnel 24 hours every day. Standard treatment guidelines were observed by the staff according to the World Health Organization (WHO) cholera treatment guidelines [8].

On 8th February the Lusaka District Medical Office informed the Zambian Ministry of Health (MoH) of the cholera outbreak. A team comprising of MoH epidemiologists, Field Epidemiology Training Program (FETP) residents, environmental health officers, laboratory personnel, and a WHO surveillance officer was sent to verify the outbreak, determine its magnitude, identify the source, and to implement control and preventive measures.

Methods

We conducted a retrospective analysis of cholera cases in Lusaka district. After modifying the case definition in the National Technical Guidelines of the Integrated Diseases Surveillance and Response (IDSR) [7], investigators defined a suspected cholera case-patient as any resident of Lusaka district with acute watery diarrhea, with or without vomiting, from 2nd February– 31st May 2016. A confirmed cholera case-patient was defined as a suspected case in which *vibrio cholerae* O1 or O139 has been isolated through culture or, a case-patient epidemiologically linked to a confirmed case. Screening of suspected cases was done using the rapid cholera diagnostic test (SD Bioline-

44FK30, Standard diagnostic Inc). Cultures with the characteristic appearance of *vibrio cholerae* were confirmed by biochemical and serological tests using polyvalent O1 and mono-specific Ogawa and Inaba antisera. Susceptibility to antimicrobial agents was determined by the Kirby–Bauer disk diffusion method and interpreted as recommended by the National Committee for Clinical Laboratory Standards [16, 17] with commercial antimicrobial discs.

Table 2 Age-Specific Attack Rates and Case Fatality Rates of Cholera Cases, Lusaka District Feb-May 2016 (N=1054)

Age Groups	Population[1]	Cases	Deaths[2]	Attack Rate per 100,000	Case Fatality Rate (%)
<5	419,436	140	8	33	5.7
5-15	640,805	237	3	40	1.3
16-29	706,726	328	2	46	0.6
30-59	625,946	292	2	47	0.7
60+	52,377	47	2	90	4.2

[1]Age-specific population estimated based on age percentages in greater Lusaka. [2]Ten of the 20 deaths were brought in dead and ten died in a facility with dehydration as cause of death

Data Collection

Active case-finding was conducted by the district surveillance officers, and all cases from the three CTCs were entered in a line list. During active case-finding, cholera information, education and communication (IEC) materials were distributed to the communities. Data on age, sex, place of residence, and onset of symptoms were extracted from the line lists obtained from the three CTCs. Data including the type of test conducted, results of the test, and sensitivity patterns were extracted from records at Kanyama clinic laboratory and the national reference laboratory at University Teaching Hospital (UTH).

Environmental Assessment

We reviewed records from the environmental health department at Kanyama public clinic. Food samples had been collected from unlicensed street vendors, public markets and privately owned supermarkets in Lusaka district. Water samples were collected from water kiosks run by the Lusaka Water and Sewerage Company (LWSC), as well as selected shallow wells, boreholes, and a stream within the affected communities. Analysis of water and food samples for possible contamination with *vibrio cholerae* was conducted at the UTH Food and Drug Laboratory.

Interviews of Confirmed Patients

Laboratory-confirmed case-patients and epidemiologically-linked patients selected by convenience sampling were interviewed using a structured questionnaire. We collected demographic information, information on travel to cholera-confirmed areas (during the five day period prior to symptom onset), and food exposures (during the five day period prior to symptom onset). In addition, we collected information on drinking water sources (ie: shallow wells,

boreholes, and tap water), as well as personal hygiene practices (e.g. the presence of soap in the households, treatment of household water for drinking, washing of hands after toilet use, and storage of water). Data was also collected on perceived availability of water, and cost of water provided by LWSC.

Table 3 Residents specific Attack Rates and Case Fatality Rates of Cholera Cases, Lusaka District Feb-May 2016 (N=10541)

Residence	population	Cases	Deaths	Attack rate per 100,000	Case Fatality Rate (%)
Kanyama	366,170	336	5	185	1.5
Bauleni	132,531	301	2	227	0.7
Chawama	174,080	49	3	28	6.1
Mandevu	375,035	147	6	39	4.1
Munali	279,658	66	2	23	3.0
Matero	295,415	126	2	43	1.6
Kabwata	181,497	29	0	16	0.0
TOTAL	**2,330,200**	**1054**	**20**	**45**	**1.9**

Data Analysis

Epidemic curves were constructed from the line list based on reported date of symptom onset. We computed the attack rate (AR) using reported cases, and Central Statistics Office population projections from the 2010 census for each of the seven administrative constituencies in Lusaka district [9]. Case-fatality rate (CFR), and age-specific CFRs were calculated using cases with complete clinical information on age, sex, residence, and outcome. The numerator for the age-specific CFR was the number of deaths in the specific age group, and the denominator was the number of cases in the age-specific groups with complete clinical information. Data analysis was conducted using Epi Info version 3.5.3.

Results

Epidemic Progression

The index case was an 18-month-old female residing in the western part of Lusaka city who presented with diarrhea and vomiting on 2nd February 2016 and later died before being taken to the health facility. In total, we identified 1,054 cases that met the case definition for suspected, confirmed or epidemiologically liked cases in Lusaka district from 2nd February through to 31st May 2016. The highest absolute numbers of cholera cases were reported from Kanyama and Bauleni compounds (Table 1). The overall cholera AR in Lusaka district was 45.2/100,000 population. The median age of case-patients was 22 years (IQR: 7-32) and 54% of the cases were 5-29 years old; 48% were female (Table 1). The epidemic curve showed multiple peaks suggestive of a propagated cholera outbreak (Figure 1). The most pronounced peaks were seen on March 22nd and 19th April, respectively. By the end of May 2016, only two cases were reported.

The overall CFR was 1.9%, with 20 deaths among the 1,054 cases (Table 2). Of the 20 deaths observed in the study, 10 arrived to the health facility already deceased, and 10 died at the health facility. The age-specific CFR

was highest among children <5 years (5.7 %), followed by the 60+ age group (4.2%). The AR was highest (90/100,000) in 60+ age group (small population denominator) and lowest (33.4/100,000) in <5 age group (Table 2).

Table 4 Environmental Samples Collected from Lusaka District Feb - May 2016

Water Source	Number of samples collected	# (%) of samples with *Vibrio cholerae*
Treated tap water	172	6 (3.5)
Shallow wells	91	48 (53)
Borehole	50	5 (10)
Stream	1	0 (0)
Total	**314**	**59 (19)**
Food sources		
Street Vendors	23	2
Public Markets	25	3 (12)
Supermarket (Kanyama)	3	0 (0)
Household Foods	0	0 (0)
Total	**51**	**5 (10)**
Total samples	**365**	**64 (17.5)**

Table 3 details the AR and CFR by location, with the highest AR in Bauleni with 227 cases per 100,000 residents, followed by Kanyama at 185 cases per 100,000 residents. All other locations had fewer than 50 cases per 100,000 population; however, the CFR was highest in the areas with fewer cases, with a CFR of 6.1% in Chawama (49 cases), 4.1% in Mandevu (147 cases), and 3.0% in Munali (66 cases).

Laboratory testing

A total of 170 stool specimens were tested. Rapid cholera diagnostic test (RDT) was done on 125 stool specimens, of which 90 (72.0%) were positive. Culture was done on 45 stool specimens, of which 20 (44.4%) were positive (Table 1). Laboratory analyses showed that the circulating strain was *Vibrio Cholerae* sero-group 01 Ogawa, biotype *El* Tor, and was sensitive to both ciprofloxacin and chloramphenicol. It's worth noting that only two antibiotics (ciprofloxacin and chloramphenicol) where tested for antibiotic susceptibility due to non-availability of reagents for the other recommended antibiotics for cholera treatment.

A total of 314 water samples from shallow wells, boreholes, stream and tap water were analyzed, of which 59 (18.8%) yielded *Vibrio cholerae.* Five out of 51 (9.8 %) food samples from street vendors and markets were contaminated with *vibrio cholerae* (Table 4).

Confirmed Case-Patient Interviews

A total of 44 case-patients were interviewed using the structured questionnaire. The median age of the interviewed case-patients was 20 years (IQR 5-15) and 57% were female (Table 5). Of the patients interviewed, 64% drank from boreholes, 27% from shallow wells, and 9% from community water kiosks operated by LWSC (Table 4). The majority of cases reported washing hands after using the toilet (87%) and washing hands before handling food (84%), but only 23% reported washing hands before drinking water.

Table 5 Self-reported characteristics of selected confirmed cholera cases in Lusaka District, February 2016 (N=44)

Characteristic	Categories	Number (%)
Sex	Female	25 (57)
	Male	19 (43)
Age (median = 20)	<5	9 (21)
	5-15	7 (16)
	16-29	11 (25)
	30-59	15 (34)
	60+	0 (0)
Education	No education	8 (18)
	Primary	15 (34)
	Secondary	10 (23)
	Tertiary	1 (2)
Water sources in the last 5 days prior to symptom onset	Borehole	28 (64)
	Shallow well	12 (27)
	Water kiosks	4 (9)
Hand washing practices	Running water with soap	10 (23)
	Stagnant water with soap	6 (14)
	Running water only	21 (48)
	Stagnant water only	7 (16)
	Before handling food	37 (84)
	Before handling drinking water	10 (23)
	After visiting the toilet	39 (87)
	After handling baby's nappies	9 (21)
Type of toilet	Modern flush toilet	4 (9)
	Pit latrine	40 (91)
Waste disposal	Burning	3 (7)
	Refuse pit	33 (75)
	Burying	4 (9)
	Dumping	4 (9)
Foods consumed 5 days prior to symptom onset	Nshima hot	40 (91)
	Nshima cold	4 (9)
	Vegetables hot	39 (89)
	Vegetables cold	2 (5)
	Rice hot	2 (5)
	Rice cold	0 (0)
	Beef hot	17 (39)
	Beef cold	1 (2)
	Sausage hot	0 (0)
	Sausage cold	0 (0)
	Munkoyo cold	11 (25)
	Munkoyo hot	0 (0)
Treatment of drinking water	Boiled	12 (27)
	Boiled and chlorinated	2 (6)
	Chlorinated	16 (36)
	Did not treat	14 (32)

Each person in the community had to pay approximately $0.05 to access 20 liters of water at the water kiosks every day. Hand washing with soap was reported by 23% of the interviewees, whereas 48% reported washing hands without soap. The majority (91%) had pit latrines in their households, and waste disposal was commonly done in refuse pits (75%). Drinking water was treated with chlorine for 36% of interviewees, boiled by 27%, both boiled and chlorinated by 6%, and not treated by 32% of the cases.

Discussion

After five years without reported cholera cases in Lusaka district, an outbreak occurred at the beginning of February 2016 with 1,054 cases of cholera reported by the end of May 2016. This outbreak had a CFR of 1.9%, which was slightly lower than the CFR of 2.1% in the 2010-11 and the CFR of 4.5% in the 2004 Zambian outbreaks [10]. The World Health Organization (WHO) recommends that cholera CFRs should not exceed 1% if cases are properly treated, yet most cholera outbreaks worldwide continue to have CFRs that exceed this threshold [11,12]. Correct case management by qualified staff, availability of rehydration fluids, and good coordination are associated with low CFRs, whereas poor access to health facilities and lack of knowledge (on prevention and transmission of cholera) has been blamed for higher CFRs in other outbreaks [12,13,14]. In an outbreak in Guinea Bissau, for example, those who died were six times more likely not to have sought care in a health center [13]. In the current outbreak in Lusaka district, ten of the 20 deaths (50%) had died before they reached the CTC. The ten that died in the facility due to severe dehydration,

representing a CFR of less than 1%. This may indicate adequate provision of standard treatment (rehydration and antibiotic therapy) to case-patients admitted to the CTCs.

The epidemiological curve could have indicated a propagated spread of the cholera outbreak, suggestive of a common source, however no links could be established among different compounds in Lusaka where the cases where coming from. There was a possibility that cholera cases from different areas had their own source of the outbreak. There was thus need to design and conduct a study which could have helped better understand how the outbreak affected different compounds in the same time period.

The importance of sanitation and access to clean water to prevent future cholera outbreaks cannot be overemphasized. The current cholera epidemic in Lusaka occurred in the western, Northern and eastern peri-urban sections of the city where there is poor sanitation and a lack of access to clean and safe water. Several studies have documented the association of poor sanitation and lack of safe water to outbreaks of cholera in the aforementioned areas of Lusaka district [1, 4, 5, 6, 10]. The poor access to clean water was evidenced by the use of water sources which were contaminated with *Vibrio cholerae*. With flooding that occurs in the rainy season, fecal contamination increases the risk of cholera outbreaks. Given that most households in the affected communities live on less than $1 per day, many residents are unable to afford the fee to access the treated water from LWSC kiosks, and might be forced to use water from contaminated shallow wells [15]. Testing shallow wells for fecal contamination during rainy season, and providing safe drinking water for free when contamination is likely, could prevent future cholera outbreaks.

Similarly, the presence of *Vibrio cholerae* in selected food samples posed a risk to the public. These foods were being sold to the unsuspecting public, and could have contributed to the spread of the cholera outbreak. A study done in Lusaka to determine risk factors associated with cholera outbreaks found that consuming street-vended foods was significantly associated with increased risk of being infected with cholera [10]. These contaminated foods could have thus contributed to the progression of the outbreak. There is need to conduct more analytic studies to determine the safety of street-vended foods during cholera outbreaks.

Our findings also showed that hand washing with soap was not a routine activity among

interviewed patients. Handwashing, if done correctly, has a protective effect in the prevention of cholera [1]. Thus there is a need to sensitize the communities on the importance and significance of handwashing with soap.

Additionally, the proportion of children <5 years with cholera is a cause for concern. It should be noted that the current IDSR case definition for cholera does not capture children <5 years diarrhea due to the commonality of diarrhea among this group. In countries endemic for cholera, a review of the case definition is usually recommended to include cases below the age of five years because children have the highest risk of death [14]. In this outbreak, children under 5 years old, and seniors over 60 years had the highest case fatality rates, suggesting that they should be prioritized for future preventative interventions.

Finally, the 2016 cholera outbreak started late, compared with the normal seasonal pattern of cholera in the country [4, 6]. The first case in Lusaka was declared in early February 2016 and ended in late May. In contrast, prior outbreaks began in mid-October (start of the rain season) and ended by late April (end of the rain season), coinciding with the usual rainy season [4, 6]. In 2016, however, there was a delay in the rains starting in most parts of the country, probably due to the El Nino effect, and this could have contributed to the late start of the cholera epidemic. The 2016 outbreak indicates a need to closely observe weather patterns in Zambia, in order to help anticipate cholera outbreaks and allocate necessary resources for surveillance and treatment.

One of the limitations of this study was the lack of inclusion of controls for the examination of risk factors. Previous studies conducted in Zambia to determine risk factors and triggers for cholera outbreaks have shown strong associations between consumption of street vended foods and cholera outbreaks. Furthermore these studies also highlighted the protective effect of consuming dried sardines (kapenta in local language) and handwashing with soap [1]. However, the risk/protective factors for this cholera epidemic are poorly understood thus far. As such, there is need to conduct an analytical study to help understand the factors that triggered the current epidemic.

In addition, the investigation relied on records from CTC, and cases that did not present at the health centers may have been missed. In addition, the 10 cases that died before arriving at the health facility were diagnosed based on clinical symptoms reported by the caregivers, because no stool

samples were collected for laboratory confirmation. Another limitation was that convenient sampling was used in the selection of confirmed cases for interviews as well as in the selection of environmental samples for laboratory investigations. There was also lack of a standard methodology on the steps taken to process the environmental samples.

In spite of these limitations, this study is informative in describing the most current outbreak of cholera in Zambia and has highlighted the importance of surveillance, prompt treatment, and safe water sources for the prevention of future cholera-related fatalities.

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PERSPECTIVES

Keep Our Future Generation Alive: Reinforcing Routine HIV Testing and Treatment Among Children in Zambia

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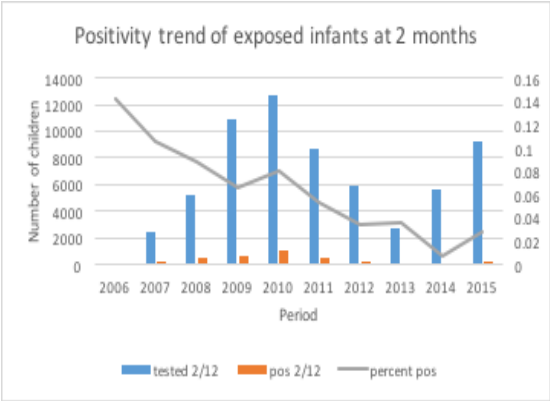
Only 3% of children visiting clinics are tested for HIV, despite Ministry of Health recommendations to test and treat ALL children.
If unidentified and left untreated, 75% of HIV positive children die by the age of 5 years.
Reinforcement of routine HIV testing and treatment of children will increase testing up to 90 - 95%, and importantly reduce mortality by 52%.
Adding Integrated Primary School Screening will reach 5-10 year olds who were not previously tested.

The Problem

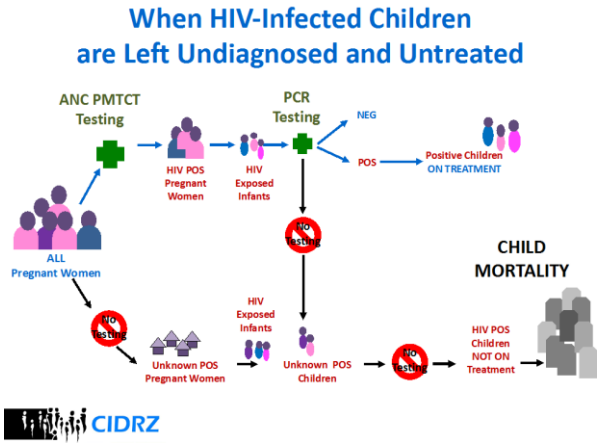
Zambia has made great strides in tackling the HIV/AIDS epidemic, initiating 58% of HIV infected people on treatment [1], prescribing more effective drugs, and delivering these services "closer to home". Over the past 10 years the prevention-of-mother-to-child-transmission (PMTCT) of HIV has changed from single dose anti-retroviral prevention to full Anti-Retroviral Treatment (ART), reducing the percentage of HIV infected children being born of HIV positive mothers from 7% to 2%. However, despite these efforts, there are approximately 36,000 HIV positive children not being identified through HIV testing annually, according to national estimate [1]. To address this child testing gap a team from the Centre for Infectious Disease Research in Zambia (CIDRZ) developed a model to estimate the number of unidentified positive children in the catchment population of 338 CIDRZ-supported facilities in the Lusaka, Western, and Eastern Provinces of the Zambia. The model results indicated that



Source: CIDRZ Annual Progress Reports 2006-2015

from 2006 through to the end of 2015, there were 30,203 HIV positive children that had died from HIV-related conditions. In addition, there was an estimated 14,348 HIV-infected children that remained untested, unidentified, and therefore untreated. Recent literature from sub-Saharan African indicates that 75% of those unidentified HIV infected children will die by the age of 5, while up to 80% will die by the age of 10, if they remain without HIV treatment [2].

Since 2008, Zambia has recommended routine HIV testing at immunization clinics



for those children born to HIV-positive mothers who attended antenatal clinics. This has increased the testing of HIV-exposed infants to 98%. But after the HIV-exposed child reaches one year of age they no longer receive regular testing. Children, of mothers who did not attend antenatal clinics and have unknown HIV status, are missed and do not receive routine HIV testing.

Though the Ministry of Health has promoted Provider Initiated Testing and Counselling (PITC) in Out-Patient departments, the uptake of child testing is very low at only 3% compared to the 40% of adult testing found in most clinics. Healthcare staff are reluctant to ask permission to test a child, especially when the accompanying adult is not the parent. Non-parent caregivers are also reluctant to give permission for testing. Mothers tend to refuse having their child being tested if they don't have the father's or the spouse's permission. This results in an "Opt-In" approach that presents many missed opportunities for child testing.

Policy options

In order to find all children living with HIV, reinforcement of routine HIV testing with community sensitization on the importance of HIV testing in children is essential. Proposed policy options to achieve these include: (1) Reinforcing Routine HIV testing; (2) Introducing Pre- and Primary School Screening Drives; and (3) Introducing Primary School Entry Screening

Reinforcing Routine HIV Testing Strategy:
WHAT: Routinely test all children for HIV, regardless of their age and condition as long as they visit a health facility with adequate information provided to the caregiver.

WHY: 80% of children up to 2 years of age, and 50% of children up to 5 years of age visit a health facility,

No Intervention in 2015			
Age (yrs)	**NEW on ART**	**NOT on ART**	**Died**
1	132	915	1081
2	324	1411	317
3	195	2154	239
4	124	1869	221
5	107	1323	159
6	116	1360	94
7	117	1253	87
8	151	1570	110
9	115	1283	89
10	119	1209	85
Total	**1500**	**14348**	**2483**

but currently only 3 out of every 100 children are tested for HIV in Outpatient Departments. Routine testing removes the responsibility for the decision of testing from healthcare workers and parents/caregivers. According to literature in Zimbabwe [3] and Tanzania [4] this strategy has increased child testing up to 90%. In our model, applying reinforcing routine HIV testing in 2015 for 0-10 year olds would have identified an additional 39% untested HIV-positive, and would have prevented 52% of child deaths.

FEASIBILITY: MEDIUM to HIGH This strategy builds on the government's decision to identify HIV positive children. It will require a reinforced **legal framework**,

Reinforcing Routine HIV Testing in 2015		
NEW on ART	**NOT on ART**	**Died**
1265	425	439
1415	538	98
1055	1379	153
860	1219	135
635	858	95
638	876	56
601	804	51
760	1007	64
609	825	53
589	775	49
8429	**8707**	**1195**

community sensitization, placement of more trained counsellors, and an increase in HIV test kits.

Introducing Screening Drives at Pre- and Primary Schools

WHAT: Conduct integrated screening drives for Pre-School and Primary School children, assessing development, eyes, ears, and dental, immunization status, and testing for malaria, TB and HIV.

WHY: 80% of children in Zambia attend Pre or Primary school. This strategy will find the

5 to 10-year-old HIV positive children that have been missed during usual health services. In our model, applying School Screening Drive in 2015 for school-goers would have identified, 50% of untested HIV-positive children (5-10-year-old), and will reduce 5-10-year child deaths by 54%. Additional benefits of school screening include reducing absenteeism and improve school performance [5].

ESTIMATED COSTS BY OPTION	Option 1 Routine Testing	Option 2 Pre & Primary School Drives	Option 3 Pre-School Entry Screening
Positive Children Found in 1 yr	6,929	4,311	528
Lives Saved in 1 yr	1,288	336	64
Annual Testing Cost (testing, HR, training, community sensitisation)	$1,289,722	$2,375,951	$493,476
Testing Cost Per Positive Child	$186	$551	$934
Annual Treatment Cost (testing, HR, training, community sensitisation)	$1,216,060	$1,133,911	$138,967
Treatment Cost Per Positive Child	$176	$263	$263
Political Feasibility			
Operational Feasibility			

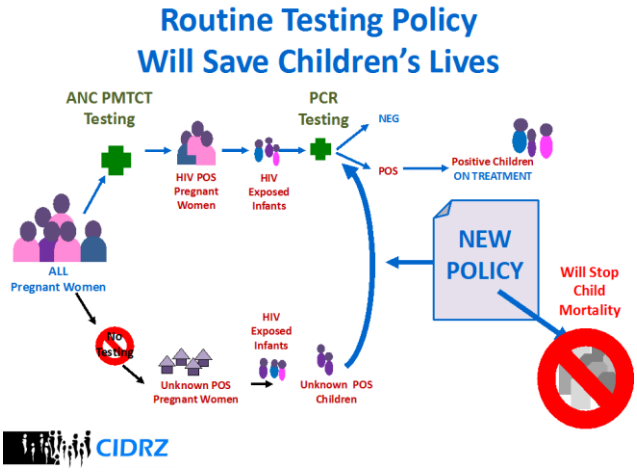
FEASIBILITY: HIGH This strategy will require community sensitization, funds, transport, and human resource, including orientation in school screening for nurses in collaboration with Ministry of Education and other key stakeholders.

Introducing Primary School Entry Screening

WHAT: Conduct integrated screening for new children entering Primary School, assessing development, eyes, ears, and dental, immunization status and test for malaria, TB and HIV before the child is enrolled.

WHY: 80% of children in Zambia attend Pre- and Primary School. In our model, this strategy will identify 35% of the 5-year-old HIV positive children who were missed in the health facilities, and will prevent 40% of death among 5 year olds. Additional benefits of school screening include reducing absenteeism and improve school performance.

FEASIBILTY: HIGH This strategy builds on health services already available at the clinic for children. Children can visit the clinic for school entry testing. Nurses will require orientation on screening activities, and collaboration will be needed with the Ministry of Education and other key stakeholders.



Recommendations

Reinforcing Routine HIV testing is the most cost effective and feasible option to increase HIV testing among children with unknown status, as recommended by the WHO [6] and the CDC [7]. Implementation of routine HIV testing will identify the majority of HIV-positive children in Zambia, reduce HIV-related mortality and promote long-term control of the epidemic. In addition to a legal framework and collaboration amongst stakeholders this strategy will require:

- Additional test kits, more trained counsellors, and a robust referral system to link children to treatment.
- Ministry of Health to intensify community sensitization and trainings for healthcare providers.
- Ministry of Finance to ensure sufficient resources so all identified children can be placed on treatment.
- Additional school screening will identify children who were missed at the health institutions

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