A RETROSPECTIVE ANALYSIS OF MEASLES TRENDS AND VACCINATION COVERAGE IN ZAMBIA FROM 2016 TO 2018

Research Article

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Introduction

Measles is a highly contagious infection caused by the measles virus (MeV). The MeV is transmitted from person-to-person via respiratory droplets or aerosolized small particles suspended in the air as a result of sneezing or coughing. On average, a single measles case infects 9-18 people (Ro= 9-18); in comparison, a person infected with influenza only infects 2-3 people (Ro= 2-3).1

Prior to the introduction of the measles vaccine in the 1960s, measles was a leading cause of childhood mortality, accounting for 2 million deaths globally each year. The number of measles deaths decreased drastically due to the initiation of the Expanded Program on Immunization in 1974 and subsequent increase in global measles vaccination coverage.2 Approximately 110,000 measles deaths were reported in 2017.

The World Health Organization (WHO) recommends that a child receive the first dose of measles vaccine (MCV1) at 9 months. However, MCV1 can be administered at 6 months if the infant lives in an area experiencing a measles outbreak, is classified as an internally displaced person or a refugee, or is born with HIV. The measles vaccine (MCV) is 85% effective in children vaccinated at 9 months. In countries that schedule MCV1 at 9 months, a second dose of MCV (MCV2) is recommended at 15-18 months. The estimated 2015 global coverage for MCV1 and MCV2 was 85% and 61%, respectively.1

In the 1990s measles immunisation coverage in Zambia was less than 70%, and measles outbreaks occurred on a yearly basis. In 1991 Zambia reported 1,698 cases of measles, and in 1999 the number rose to 23,518 measles cases. During the 1999 measles outbreak the mortality rate in hospitalized children was 13.7%.3 In response, Zambia launched supplemental immunisation activities (SIAs) targeting children between 9 months and 4 years of age to increase immunity in the under five population.4 Zambia continued its routine MCV immunisation program and performed additional MCV SIAs in 2000, 2003, 2007, and 2010.4 Despite the incorporation of MCV SIAs, Zambia experienced a measles outbreak in 2010/2011 that resulted in 35,572 cases and 242 deaths (Case Fatality Rate: 0.64%).3,5

In September 2018, Zambia launched a national immunisation campaign using a combined measles and rubella vaccine targeting all children between the ages of 9 months and 15 years. The routine childhood immunisation schedule in Zambia recommends administration of MCV1 at 9 months and MCV2 at 18 months. In 2015, the Zambian MCV1 and MCV2 coverage estimates were 90% and 47%, respectively.6 Currently, Zambia seeks to achieve 95% child MCV coverage each year through its routine immunization program.

The number of measles cases and deaths due to measles in Zambia has been steadily declining over the past decade. In order to determine the trends in measles cases in Zambia during the past few years, we analyzed national surveillance and immunisation data from 2016-2018.

Methods

To identify weekly trends in measles cases in Zambia, we conducted a retrospective analysis of measles data collected using the Integrated Disease Surveillance and Response (IDSR) system between 2016 and 2018. Data was extracted from the weekly 2016, 2017 and 2018 IDSR reports and analyzed using Microsoft Excel and STATA. To determine national MCV1 and MCV2 immunisation coverage from 2016-2018, we accessed childhood immunisation data reported in the Zambian Health Management Information Systems (HMIS). Vaccination coverage was calculated by dividing the reported annual number of MCV1 and MCV2 doses administered by the estimated number of children <1 year (MCV1) and <2 year (MCV2), as determined by projected census data adjusted for annual population growth. All surveillance data used in this paper were generated within the IDS framework of Zambia and represents the national picture of reported measles cases.

Results

The IDSR definition of a suspected measles case is: any person with fever and maculopapular generalized rash and cough, coryza or conjunctivitis, or any person in whom a clinician suspects measles. Using the IDSR definition, Zambia reported a total of 688 in 2016, 606 in 2017 and 558 suspected measles cases in 2018 (Table 1).

In 2018, a spike in the number of suspected measles cases occurred on epidemiological week 17, during which 35 suspected cases were reported in North-western province (Figure 1 & Figure 2). Twenty suspected measles cases were reported in Luapula province in epidemiological week 30 (Figure 2). During this period, from July 5th to July 30th 2018, 24 suspected measles cases were reported in six districts in Luapula province (Mansa, Mwense, Mwansabombwe, Nchelenge, Lunga and Samfya). Sixteen patients...
Figure 1: Reported suspected measles cases in Zambia 2016-2018

Figure 2: Trends in suspected measles cases by province (2018)
were treated for measles and discharged from health facilities, and one fatality was reported in the community. In response, a field investigation was undertaken in the affected districts. Blood samples from all 24 suspected measles cases were sent to the virology laboratory at University Teaching Hospital (UTH) for laboratory confirmation, and four measles cases from the Paul-Mambilima Regional Health Center in Mansa district were laboratory confirmed. As a result, a mass MCV campaign was carried out in the Paul-Mambilima Regional Health Center catchment area for children between the ages of 4 months and 15 years. The highest number of suspected measles cases (43 cases) was reported during week 47 (Figure 1). Twenty of the 43 cases were reported from Central province.

Without factoring the total population at risk per province, Luapula province reported the highest number of suspected measles cases (114 suspected cases) in 2018, and North-western province reported the second highest number of suspected measles cases (83 suspected cases). The lowest numbers of suspected measles cases were observed in Eastern (18 suspected cases) and Muchinga (6 suspected cases) provinces (Figure 3).

Suspected cases of measles are confirmed by laboratory testing. Blood samples are collected from suspected cholera cases and sent to UTH for serologic testing for measles virus specific antibodies (IgM). In 2016, 61% of all suspected cases had blood samples sent to UTH for laboratory confirmation. In 2017 and 2018 75% and 62% of suspected cases were tested at UTH, respectively (Table 1). Of the 420 blood samples sent for laboratory confirmation in 2016, only 6 (1.4%) tested positive for measles. In 2017, 456 samples were sent for laboratory confirmation and only 12 (2.6%) were positive (Table 1). In 2018, only 19 (5.5%) out of the 344 suspected blood samples tested positive. The highest number of confirmed measles cases (13 cases) in 2018 occurred during the third quarter (Table 1).

During this same period, MCV1 coverage in Zambia decreased from 97% in 2016 to 93% in 2018 (Figure 4). Despite the decrease in MCV1 coverage, MCV2 coverage increased from 58% in 2016 to 66% in 2018 (Figure 4).
In 2018 Zambia reported 558 suspected measles cases. Peaks in the numbers of reported suspected measles cases occurred on epidemiological weeks 17, 30, and 47. A field investigation into an increase in suspected measles cases in Luapula province on week 30 led to a mass MCV campaign in Mansa district. Slightly more than one third of all measles cases reported in 2018 were from Luapula and North-western provinces. These provinces border the Democratic Republic of the Congo, where ongoing conflicts and disease outbreaks have disrupted routine childhood immunisations and led to an increase in cases of vaccine-preventable diseases. As a result, the DRC reported 6,949 suspected cases of measles in 2018.

Similarly, the 2010-2011 measles outbreak in Zambia was largely influenced by cross-border transmission of measles from neighboring countries. Spatial clustering of the 2010-2011 outbreak showed that frequent border crossing of the Chewa people between Zambia and Malawi led to measles importation in border towns.

The measles virus can only remain in circulation in human populations if transmission is undisrupted. In order to achieve herd immunity and prevent the transmission of measles, 90-95% of a population must be immune to the disease. The goal of the Zambian government is to achieve 95% MCV coverage in children under 5 years old. In 2016, 97% of children under the age of 1 year received MCV1, and 58% of children under the age of 2 years received MCV2. MCV1 coverage decreased to 93% in 2018, below the 95% goal, yet MCV2 coverage increased to 66%. High levels of MCV1 and MCV2 must be maintained in order to eliminate measles in Zambia and reduce the risk of cross-border transmission of measles from neighboring countries.

Several factors can influence vaccine uptake, including availability of vaccines, proximity of populations to health facilities, cultural or religious beliefs, and poor knowledge of or misinformation about vaccines. In resource poor areas, researchers have found that some nurses are reluctant to open a multi-dose vaccine, for fear that they will waste the remaining doses. Furthermore, as measles cases become more rare, the perceived threat of measles in the population decreases, causing vaccination compliance to also decrease.

Review of the 2016-2018 laboratory data showed that only 0.8% (2016) to 3.4% (2018) of suspected measles cases were identified as positive by laboratory confirmation. This is partly due to the suspected measles case definition used by the IDSR. The suspected case definition is very broad, because the definition must be highly sensitive in order to detect all measles cases and prevent rapid spread of measles. It is less important for the case definition to be specific, so many other viral diseases are detected using the suspected measles case definition. However, another factor is that the proportion of blood samples collected from suspected measles cases for laboratory confirmation was only 62% in 2018. According to WHO, ≥ 80% of all suspected measles cases must provide blood samples in order to detect an outbreak.

Conclusion & Recommendations

Due to improvements in routine childhood immunisation programs and national surveillance systems over the past 20 years, the number of suspected measles cases in Zambia has decreased drastically from 35,572 in 2010 to 558 in 2018.

While it is evident that Zambia is making progress towards achieving the 95% WHO recommended vaccination coverage, much work must be done to improve MCV2 coverage. In order to interrupt measles transmission in the country, areas with low vaccine coverage should be targeted, with an emphasis on strengthening immunisation coordination programs in border regions.

Zambia in partnership with the WHO and UNICEF have greatly improved measles surveillance over the last two decades by implementing IDSR. IDSR has helped with early detection of measles cases and the prevention of large scale outbreaks. However, it is important to continue to train healthcare workers in IDSR definitions in order to promote timely and accurate reporting of data. Sensitization of healthcare workers about measles case definitions and reporting procedures could also help increase the proportion of suspected measles cases for whom samples are collected and sent to UTH for laboratory confirmation.
### Table 1: Measles laboratory confirmation in Zambia (2016-2018)

<table>
<thead>
<tr>
<th>Year</th>
<th>Quarter</th>
<th>Suspected measles cases</th>
<th>Laboratory</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Positive</td>
<td>Negative</td>
<td>Indeterminate</td>
</tr>
<tr>
<td>2016</td>
<td>Quarter 1</td>
<td>212</td>
<td>3</td>
<td>132</td>
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<tr>
<td></td>
<td>Quarter 2</td>
<td>188</td>
<td>2</td>
<td>76</td>
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<tr>
<td></td>
<td>Quarter 3</td>
<td>168</td>
<td>0</td>
<td>117</td>
</tr>
<tr>
<td></td>
<td>Quarter 4</td>
<td>120</td>
<td>1</td>
<td>67</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>688</strong></td>
<td><strong>6</strong></td>
<td><strong>392</strong></td>
</tr>
<tr>
<td>2017</td>
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<td>69</td>
</tr>
<tr>
<td></td>
<td>Quarter 2</td>
<td>170</td>
<td>3</td>
<td>99</td>
</tr>
<tr>
<td></td>
<td>Quarter 3</td>
<td>138</td>
<td>0</td>
<td>119</td>
</tr>
<tr>
<td></td>
<td>Quarter 4</td>
<td>183</td>
<td>9</td>
<td>131</td>
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<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>606</strong></td>
<td><strong>12</strong></td>
<td><strong>418</strong></td>
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<tr>
<td>2018</td>
<td>Quarter 1</td>
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<td>76</td>
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<tr>
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<td>Quarter 2</td>
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<td>74</td>
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<tr>
<td></td>
<td>Quarter 3</td>
<td>191</td>
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<td>75</td>
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<tr>
<td></td>
<td>Quarter 4</td>
<td>140</td>
<td>4</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>558</strong></td>
<td><strong>19</strong></td>
<td><strong>236</strong></td>
</tr>
</tbody>
</table>
LIST OF REFERENCES


