Sero-Prevalence of Measles in Southern Darfur State, Sudan

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Introduction

Measles is an acute, highly infectious viral disease. The disease symptoms start with a cough, fever, and a maculopapular rash that can lead to severe complications, including acute diarrhea, encephalitis, ear infection, blindness, inflammation of the brain, and pneumonia, followed by substantial morbidity mainly in a developing country [1,2].

Despite the unique national childhood vaccination campaigns that have been successfully used to control measles morbidly and mortality over the past years, measles continues to be endemic in many developing countries. The ways for prevention and control of measles elimination are especially challenging to implement in East Africa, because of its limited infrastructure and political instability [3], in addition to the insufficient vaccination coverage, logistical problems related to cold chain maintenance, and civil wars. Therefore, measles remains a public health concern in developing areas [4,5].

In developing areas of Africa and Asia countries, measles affects about 20 million people a year [6,7], and 95% of measles death cases occur in developing countries with weak health infrastructures [2].

In the African region, where the measles vaccine was introduced in the 1970s, the mortality was declined to 40% [8]. Recent studies indicated that measles-related death was decreased by 90% between 2000 and 2008 through the effective implementation of WHO and UNICEF-recommended control strategies [9]. A second dose of measles-containing vaccine given during supplemental immunization activities played a vital role in raising the population's immunity levels. However, routine vaccination coverage remains low, and health systems are still weak [9,10]. The previous study showed that 86.8% of children were positive for the anti-measles virus-specific IgM antibodies [11].

Recently more than 1600 suspected measles cases with 710 confirmed have been reported from 23 localities in 12 states of Sudan...
Among studied cases, 222 (43.4%) were males, and 289 (56.6%) were females, their ages ranged from 1 to 15– years. Cases aged less than five years old were most affected by measles compared with other aged groups (Figure 1).

The seasonality of suspected measles cases indicates that measles cases were increased during February, March, April, May, and June. Whereas, the measles cases were decreased in July, August, September, October, and December (Figure 2).

Measles lab-confirmed cases are high compared with Epi-linked and Measles compatible cases in different health zones (Figure 3). Measles positive and negative cases in different health zones are presented in figure 4.

Measles clinical symptoms were fever 511 (100%), cough 511 (100%), maculopapular rash 511 (100%), running nose 113 (22.1%), conjunctivitis 344 (67.3%), arthritis 132 (25.8%), and lymphadenopathy 34 (6.7%). However, 128 (25.0%) of measles cases displayed severe complications, and 502 (98.2%) were recovered during the hospitalization, while the mortality rate was 9 (1.8%) (Table1).

There were clinically significant differences in gender ($\chi^2=55.68$, P<0.001), age year ($\chi^2=48.83$, P<0.001) and presence of antibody in the serum for measles IgM antibody ($\chi^2=261.27$, P<0.001) (Table 2).

Discussion

Measles remains among the top causes of death in young children globally [6]. Due to its high infectious rates and the potential severity of complications, measles often constitutes a severe public health event entailing a vigorous response from public health departments and can involve multiple states and counties [13]. In Sudan, the measles was reported in Gedarif and Kassala States in December 2014. Recently, new cases were reported among internal displacement people in Northern Darfur (Jabel Amer, Sharaf Omra) [14]. The present study indicated that measles remained a public health concern in Southern Darfur state. Among measles cases, the percentage of females was higher than males, and most cases were reported in aged less than five years. Several epidemiological studies have shown that infection with measles occurred within the first years of life [15,16]. Previous research indicated that 5% of deaths arose in children less than five years age despite the availability of a safe and effective vaccine [17].

In this study, we noticed an increase in measles cases in March and decreased in December every year. Dry (December-May) and rainy (June-November) seasons were found to influence the effect of measles
The prevalence of positive measles IgM antibody was 43.4% in males and 56.6% in females. 48.5% of children have positive measles IgM antibody. However, Getahun M, et al. reported 31.3% positive measles-specific IgM in the Ethiopian population [21].

The most common clinical symptoms of measles were fever and skin rash followed by a cough, conjunctivitis and running nose. In virus on mortality [18]. Yang Q, et al. reported that both hot and cold temperatures decrease the incidence of measles, and low relative humidity is a risk factor for measles morbidity [19]. In temperate climates, measles typically occurs in the late winter and early spring every year, whereas, in the tropics, measles has irregular associations with rainy seasons [20].
Table 1: Clinical presentation of the measles cases.

| Characteristics       | Categories | No.  | (%)   |
|-----------------------|------------|------|-------|
| Fever                 | Yes        | 511  | (100) |
| A cough               | Yes        | 511  | (100) |
| Rash                  | Yes        | 511  | (100) |
| Conjunctivitis        | Yes        | 344  | (67.3)|
|                       | No         | 55   | (10.8)|
|                       | Unknown    | 112  | (21.9)|
| Running nose          | Yes        | 113  | (22.1)|
|                       | No         | 322  | (63)  |
|                       | Unknown    | 76   | (14.9)|
| Arthritis             | Yes        | 132  | (25.6)|
|                       | No         | 265  | (51.9)|
|                       | Unknown    | 114  | (22.3)|
| Conjunctivitis        | Yes        | 344  | (67.3)|
|                       | No         | 281  | (55)  |
|                       | Unknown    | 196  | (38.4)|
| Complication          | Yes, Sever | 128  | (25)  |
|                       | Uncomplicated | 259  | (50.7)|
|                       | Unknown    | 124  | (24.8)|
| Measles IgM antibody  | Negative   | 54   | (10.6)|
|                       | Positive   | 248  | (48.5)|
|                       | Unknown    | 209  | (40.9)|
| Travel history within the past 21 days | Yes | 511 | (100) |
| Vaccination status    | Vaccinated | 109  | (21.3)|
|                       | Unvaccinated | 402  | (80.7)|
| Vitamin A covered     | Yes        | 161  | (31.5)|
|                       | No         | 215  | (42.1)|
|                       | Unknown    | 135  | (26.4)|
| Measles outcome       | Recovered  | 502  | (98.8)|
|                       | Died       | 9    | (1.8) |

Table 2: Gender, age and Measles IgM antibody within the different years.

| Characteristics       | N    | 2011 (28.8) | 2012 (21.5) | 2013 (22.7) | 2014 (10.0) | 2015 (17.0) | χ²  | P-value |
|-----------------------|------|-------------|-------------|-------------|-------------|-------------|------|---------|
| Gender n (%)          | 511  | 147 (28.8)  | 110 (21.5)  | 116 (22.7)  | 51 (10.0)   | 87 (17.0)   | 55.68 | <0.001  |
| Male                  | 222  | 43 (19.3)   | 27 (12.3)   | 64 (29.4)   | 59 (26.9)   | 30 (13.9)   | 42.8  | <0.001  |
| Female                | 289  | 104 (36.1)  | 83 (28.9)   | 47 (16.2)   | 22 (7.6)    | 57 (19.5)   | 54.7  | <0.001  |
| Ratio                 | 0.23 | 1.39        | 1.04        | 1.43        | 0.93        |             |       |         |
| Age year n (%)        |      |             |             |             |             |             |       |         |
| <1                    | 41   | 8 (1.9)     | 5 (1.2)     | 15 (3.9)    | 14 (3.2)    | 12 (2.9)    | 48.83 | <0.001  |
| 4-Jan                 | 203  | 40 (19.7)   | 60 (29.3)   | 35 (17.2)   | 50 (24.6)   | 26 (12.8)   | 36.3  | <0.001  |
| 9-May                 | 95   | 28 (29.5)   | 26 (27.7)   | 26 (27.7)   | 23 (24.2)   | 11 (11.6)   | 7.1   |         |
| 14-Oct                | 57   | 11 (19.4)   | 12 (21.1)   | 12 (21.1)   | 19 (34.5)   | 7 (13.0)    | 8.1   |         |
| ≥15                   | 115  | 43 (37.5)   | 27 (23.5)   | 10 (8.7)    | 7 (6.1)     | 28 (24.3)   |       |         |
| Measles IgM antibody  |      |             |             |             |             |             |       |         |
| Negative              | 54   | 6 (1.2)     | 11 (2.2)    | 11 (2.2)    | 22 (4.3)    | 4 (0.8)     | 261.3 | <0.001  |
| Positive              | 248  | 33 (6.3)    | 27 (5.3)    | 82 (16.1)   | 27 (5.5)    | 79 (15.5)   |       |         |
| Unknown               | 208  | 108 (52.1)  | 72 (34.6)   | 22 (10.6)   | 2 (1.0)     | 5 (2.4)     |       |         |

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contrast, Ibrahim SA, et al. indicated that cough and conjunctivitis were the most common manifestation followed by a running nose in Khartoum state [22]. White SJ, et al. reported that the prodromal stage occurs 10 to 12 days after exposure and is characterized by two to three days of fever, anorexia, and malaise combined with the triad of cough, conjunctivitis, and coryza. Measles induced complications affect approximately 30% of infected individuals, especially young children aged < 5 and adults ages ≥ 20. The most commonly reported complications are diarrhea, 8%, otitis media 7%, and pneumonia 6% [23].

In the present study, 21.3% of the cases were vaccinated. The previous study indicated that the timely administration of vaccines could ensure adequate protection against measles for all ages in a population [24]. Serologic and epidemiologic studies suggest that 1-dose measles vaccine efficacy is approximately 85%-90% when given at nine months of age and that 2-dose effectiveness is >99% when the second dose is given at ≥12 months of age. A two-dose measles vaccination schedule might reduce not only child mortality but also improve growth [10]. This may confirm the previous studies on vaccination coverage in other parts of the world which shown socioeconomic status, insecurity, cultural diversity, community attitude towards measles and religion plays an important reason for lack of vaccine covered [25,26]. Furthermore, many governmental efforts were committed to the Global Measles and Rubella Elimination Strategic Plan 2012-2020. The strategies include high vaccination coverage; monitoring of disease; outbreak preparedness and response; and research and development in order, to control measles among the Sudanese population [2].

The limitations of the study are that some measles cases might not be reported during the study period. Furthermore, the study was based on clinically diagnosed with measles cases and immunization history for children, but not includes other socio-demographic data. Finally, the study concludes that the increase in measles cases in Southern Darfur State from 2011 to 2015 is likely a consequence of inadequate vaccination coverage.

Conclusion

The increase in the prevalence of measles cases in Southern Darfur state is likely a consequence of the inadequate prevention and control strategies presenting in vaccination coverage and reducing the mortality rate. Therefore, performing a continues vaccination campaign towards measles control and prevention among the population will be helpful to drop measles cases and mortality among children in South Darfur.

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Conflict of Interest

Authors have declared that no competing interests exist.

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