

Evaluation of the measles surveillance system of the Ga West Municipality, Ghana, 2017

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ABSTRACT

Introduction: Over 140,000 people globally died from measles in 2018; most of which occurred in developing countries. In Ghana, measles is one of the diseases earmarked for elimination in the Integrated Disease Surveillance and Response (IDSR) strategy. The measles surveillance system seeks to monitor trends, detect outbreaks and report in a timely manner. In order to improve upon the performance of the Ga West Municipal Measles surveillance system, it was evaluated with the aim of determining its effectiveness. **Methods:** We used CDC updated guidelines for surveillance system evaluation to assess system attributes. Measles surveillance data from 2012 – 2016 were abstracted from the DHIMS. Case investigation forms, weekly and monthly IDSR reporting forms were reviewed to validate abstracted data. Key surveillance officers were interviewed on system operations. Data was analyzed descriptively to generate frequencies and relative frequencies. **Results:** The system operated with a reasonable number of disease variables and case definition was simple to apply. The system was found to be integrated with the national IDSR. Government facilities across all seven sub-districts, owned and contributed data to the system. Of the 48 suspected case-patients, 39 (81.0%) were investigated; none of which was positive giving a Predictive value positive (PVP) of 0%. Majority of facilities (though privately owned) did not contribute data to the system. All tested samples were received at the laboratory within the stipulated three (3) days. The system was stable with available case base forms. Over 56% (22/39) of the samples tested had no vaccination records. Data is used to guide routine and supplementary immunization activities. **Conclusion:** Ga west Municipal measles surveillance system is simple, flexible and generally acceptable. It is sensitive, timely, stable but with low representativeness. It is therefore effective. Municipal health officials have been sensitized on private sector participation and need for quality and timely data.

KEYWORDS: Measles, surveillance system, Ga West Municipality, Ghana

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Introduction

Measles is a highly infectious viral disease usually recognized by its characteristic maculopapular (non-vesicular) rash. Children up to the age of 14 are the most vulnerable to the condition [1]. The infection tends to be severe in vitamin A deficient and malnourished children [1]. Measles is vaccine preventable and about 23 million lives have been prevented through the administration through measles vaccination from 2000-2018. In spite of this, measles caused over 140,000 deaths globally in 2018 [2].

About 95% of deaths due to measles occur in developing countries. One percent of deaths of children under five in Ghana in 2013 was attributed to Measles [3]. The measles surveillance system (MSS) in Ghana is sensitive; able to pick up both suspected and confirmed cases. Its objectives include monitoring trends, detection of outbreaks and reporting in a timely manner. In 2016, a total of 1,218 suspected cases were reported from 195 districts throughout the country. A measles outbreak occurred in Pru district of the Brong Ahafo Region where 6 cases were confirmed; this did not escape the radar of the MSS. [4].

In Ghana, measles is one of the diseases earmarked for elimination in the Integrated Disease Surveillance and Response (IDSR) strategy [5]. As a result, the country pursues a vigorous measles immunization programme for 9 months (MCV 1) and 18 months (MCV 2) old babies in all districts. Ga West Municipality (GWM) fully participates in the Expanded Programme on Immunization (EPI) and Supplementary Immunization Activities (SIA) which ensure that all children eligible for immunization are duly immunized.

The year 2020 has been designated as the deadline for the elimination of measles from African countries by the WHO African region. To help achieve that goal, one of the key performance indicators adopted for the measles surveillance system was that the proportion of laboratory confirmed measles cases should be less than 10% after Supplementary Immunization Activity (SIA) [6]. That notwithstanding, periodic evaluation of surveillance systems helps to improve upon the performance of the system.

We therefore evaluated the Ga West measles surveillance system to assess the effectiveness of the system in line with the attainment of the above goal.

Methods

Evaluation design

CDC updated guidelines for surveillance system evaluation was used to assess system attributes. Key informant interviews and direct observation were employed to assess simplicity, flexibility, acceptability and stability of the system. Surveillance data abstracted from DHIMS and records review provided basis for assessing sensitivity, PVP, representativeness, timeliness and data quality.

Area of surveillance

Ga West Municipality (GWM) is one of the 16 Districts / Municipalities in the Greater Accra Region of Ghana [Figure 1](#). The municipality is subdivided into seven sub-municipals namely Amasaman, Mayera, Trobu, Pokuase, Oduman, Ofankor and Kotoku with Amasaman serving as the capital. By the close of December 2016, there were 32 health facilities in the municipality, made up of 14 public ones and 18 private clinics. Population of children under five years of age was estimated to be 10,650 according to the 2018 projected figures by the Municipal Assembly.

Operations of the Measles surveillance system

The measles surveillance system operates at all five levels of the health system namely CHPS (Community), the Health Centre (Sub-municipal), the Municipal / District, regional and National level. The community level, has no disease control or public health unit. Community base volunteers report to the system at this level. Health officers that occupy Public Health Units from the sub-municipal to the national level, are all either Disease Control Officers (DCOs) or Field Technicians (FTs). DCOs present at the lower levels suspect and report cases to the next level as well as take blood samples to the National Public Health Reference Laboratory (NPHRL) for investigations. The Disease Surveillance Department representing the national level, receives report from the NPHRL and relays feedback to the regional and subsequently to the municipal and sub-municipal levels.

System attributes

Simplicity - Simplicity, defined as the ability of the system to monitor a reasonable number of disease data (variables), was assessed by Disease Control Officers' understanding and application of case definitions as well as how data or information flowed in the system.

Flexibility - The ability of the system to be integrated with another or a broader disease surveillance or health information system defines the system's flexibility. The level of integration of the MSS with the national IDSR was used to assess it.

Acceptability - This is defined as the ability of the system to gain confidence, adherence, ownership and support of key players and stakeholders. Proportion of health facilities that participated in the system by contributing samples and/or data was used to estimate acceptability.

Sensitivity - The system's ability to detect cases and outbreaks defines its sensitivity. This was determined based on the ability of the system to suspect measles cases and to detect outbreaks.

Predictive Value positive (PVP) - Defined as the proportion of suspected cases that actually have the disease, this was assessed by dividing the number of positive cases by the total number of suspected cases.

Representativeness - The ability of the system to describe cases or outbreaks in the entire surveillance system or area is defined as its representativeness. We assessed this by the proportion of health facilities that contributed data as well as the person-place distribution of the suspected cases.

Timeliness - This is defined as the ability of the system to suspect, confirm and/or submit data to another level according to stipulated timelines. This was measured at three levels. Firstly, by the collection of blood specimen and its subsequent delivery to the NPHRL within three days after collection. Secondly, by the proportions of blood specimen collected within 30 days of rash onset. Thirdly, by the release of laboratory investigation reports by DSD to the region and districts/municipalities within seven days of receiving blood specimen.

Stability - This is the availability of resources to support the system at all levels. We assessed this attribute by observing the availability of case base forms, testing reagents, sample collection bottles amongst others.

Data quality - Defined as data that is accurate, complete, timely and reliable, we estimated this by reviewing weekly and monthly IDSR report forms and validating them against those entered into DHIMS as well as calculating proportions of missing data.

Case definitions

Suspected case

Any person with fever and maculo-papular (non-vesicular) rash and fever plus one of the following: cough or coryza (runny nose) or conjunctivitis (red eyes). Any person in whom a clinician suspects measles.

Confirmed case

A suspected case with laboratory confirmation (positive IgM antibody) or epidemiological link to confirmed cases in an outbreak.

Data collection

Case definition, measles immunization charts, case base forms and other resources of the MSS were directly observed using a checklist. Data abstracted from the DHIMS at the regional and national levels were validated against those extracted from district and sub-district weekly and monthly IDSR hard copy records. Key surveillance officers at all levels system (Community, Sub-district, District, Regional and National) were purposively selected and interviewed on operations of the system.

Analysis of data

Data was analyzed descriptively to generate frequencies and relative frequencies using Microsoft Excel Office 2013. Data was organized into tables and proportions were calculated for selected variables such as age groups, sex, sub-districts and health facility ownership. Line graph was used to show trend of suspected measles cases over the period.

Ethical considerations

Ethical clearance was obtained from the Public Health Division of the Ghana Health Service (GHS). The Ga West Municipal Health Directorate gave approval for the evaluation to be conducted. Individuals who were interviewed, gave their consent.

Results

In total, 48 measles cases were suspected from 2012 to 2016, of which 81.3% (39/48) were investigated by the NPHRL. None tested positive giving a predictive value positive of zero (PVP = 0). The ages of suspected cases ranged from 6 months to 31 years. Two-thirds of those suspected were males. The mean age was 3.26 (\pm 5.4) years.

The number of suspected cases had remained constant (a case per year) over a period of three years (2012 to 2014). It however rose sharply to 15 cases in 2015 and then to 21 cases in 2016. [Figure 2](#) shows the trend of suspected measles cases in GWM.

System attributes

Simplicity and acceptability

From the interviews with key surveillance officers, it was realized that the system was simple. They demonstrated an understanding of case definitions and its application. Mode of reporting through the use of telephone, e-mail and other means of communication further simplified the system. Surveillance officers interviewed at all the levels confirmed that the system was simple and acceptable because they regularly contributed data to keep the MSS system running. DCOs/FTs contributed data regularly to the next level as and when cases were suspected.

Sensitivity and PVP

Interviews with DCOs / FTs revealed that case definitions were broad enough and captured all suspected cases. No positive cases were recorded and no outbreak was detected over the period under evaluation. PVP was calculated to be zero.

Flexibility

The Measles Surveillance System (MSS) in GWM was found to be easily integrated with other surveillance systems. The system allowed for the detection of Rubella should the disease occur among the children.

Data quality

Records available at the MHD showed no significant difference with those entered into the DHIMS. There were no discrepancies between MSS data available at the NPHRL compared to records reviewed at the DSD. Of those tested, 22 (56.4%) had no record on measles vaccination status, 3 (8%) had no record of date blood specimen was collected while 4 (10%) gave no indication of date lab report was released to the DSD giving an overall data completeness of 75%. Data quality was therefore estimated to be 86%.

Representativeness

Data contribution to the MSS was made only by public health facilities, and these made up 44% (14/32) of the entire health facilities municipality. All seven sub-municipalities have at least one or more public health facilities. The municipal hospital is located at the Amasaman sub-municipality, and contributed more suspected cases than the rest of the sub-municipalities.

Timeliness

All 39 tested samples were received at the laboratory within the stipulated three days after collection. All samples of blood specimen collected were within 30 days of rash onset. About 46% (18/39) of the samples tested were reported to the National Disease Surveillance Department within seven days. [Figure 3](#) provides a summary on timeliness.

Stability

Case base forms and sample collection bottles were available at the sub-municipal and municipal levels of the system. As a result, the system was found to be stable with occasional shortages of reagents at the NPHRL.

Discussion

The main objective of the evaluation was to determine the effectiveness of the Ga West Municipal MSS. The evaluation discovered that there was neither positive case nor outbreak recorded in the municipality over the period 2012 - 2016. However, there were a number of suspected cases recorded over the period particularly 15 in 2015 and 21 in 2016. These suspected cases could best be described as discarded measles cases by WHO standards [2,7]. We can therefore state that, per the WHO African regional office target of '80% or more of districts in a country should investigate from ≥ 1 suspected measles cases annually' [6], GWM was meeting this target over the period. Additionally, the WHO Regional Office for Africa stated in their Regional Guidelines for Measles and Rubella Surveillance that at minimum, per 100,000 population, two or more discarded measles cases should be considered adequate [8]. This decision should be arrived at after thorough investigation has been completed by a proficient laboratory. In the instance of Ghana, NPHRL is the certified laboratory mandated to carry out measles investigations. So again, GWM with a population hovering around 250,000 inhabitants on the average for the period under review [9], the first three years (2012 -2014), this surveillance indicator was not attained. The situation was different from 2015 to 2016 where the municipality recorded figures far and above what was expected. It is important to note that all the discarded measles cases met the adequacy criteria set out in the WHO guidelines according to the NPHRL, however, they tested negative for measles IgM. It can therefore be argued that measles cases were simply not present or people who had the disease failed to report to any public health facility in the municipality. On the other hand, case patients who might have reported to private health facilities could not have been captured by the MSS because private health facilities did not contribute data to the system.

The sudden jump in the numbers of suspected cases from a case per year (2012 to 2014) to 15 cases in 2015 and eventually 21 cases in 2016 could be due to increased awareness about the disease in recent times in line with the year 2020 deadline set for elimination of measles from African countries [6]. The WHO, defines measles elimination from a country as "the absence of endemic measles

transmission in a defined geographical area (e.g. region) for ≥ 12 months in the presence of a well performing surveillance system" [3]. As alluded to later in the discussion, the MSS is a passive one and as such prone to underreporting just like other surveillance systems around the globe [10]. Therefore, the low number of suspected measles cases (especially 2012 - 2014) or the complete absence of the disease in the municipality may therefore not be a true reflection of the situation on the ground.

More measles cases were suspected than investigated at the NPHRL. Of the 48 suspected cases documented by the municipality, 81% (39/48) had blood specimen collected and investigated at the NPHRL. This satisfies the WHO recommendation of at least 80% investigation of all suspected cases in a country or district, which is considered adequate for countries with elimination targets [1]. In a study by Nsubuga et al (2017) of the Case-based measles surveillance in Uganda, they found the proportion of suspected cases that were laboratory investigated to be 72% (2013 and 2015 cases), which is below the WHO recommendations [11]. The nine (9) suspected cases that were not investigated in the MSS could be due to absence of DCOs /FTs to collect blood samples or unwillingness of the patient to have his or her blood taken among other reasons. It is also possible prescribers changed their judgement about some suspected cases after a second thought and so decided not to continue with investigations.

We adjudged the MSS as simple on the basis that prescribers showed an understanding of the MSS and application of the case definitions. The fact that PHNs as well as DCOs did not need special training in order to identify persons suffering from measles further simplified matters. Additionally, information flow from one level to the other was achieved either through phone calls or e-mails. All public health facilities in the municipality contributed data weekly and monthly as required by the IDSR [5]. Surveillance officers willingly shared information on the MSS and contributed timely data to the next level, an indication of the acceptability of the system. This is similar to the findings of a measles surveillance system evaluation carried out in Southeast Ethiopia [12]. However, they based the quantification of their 95% acceptability of the system on completeness of report forms, timeliness

of data reporting and use of standard case definitions[4].

All suspected cases picked up by the MSS were negative upon laboratory investigations. As a result PVP was measured as zero. This however does not suggest that the MSS is not sensitive. The 14 public health facilities well represent the entire GWM, and the fact that the municipality has neither recorded any positive case nor outbreak in the last five years or more, is enough proof of the sensitive nature of the MSS in the municipality. But it is worth mentioning that not all the suspected cases ended up having laboratory investigations carried out on them. It may also be prudent to suggest that the laboratory procedures employed in the diagnosis might have to be looked at again to give credence to the fact that the district and for that matter Ghana, is in its near elimination stages. Moreover, WHO provided a clear guideline for countries with very low incidence of measles in some of their districts. The WHO proposed that one of the targets that should be used as a measure indicating near elimination of measles for countries is <1 incident case confirmed by laboratory investigations [7]. We can therefore state with some level of certainty GWM is one of such districts attaining this feat, barring any lapses in laboratory investigations at the NPHRL.

We found the MSS to be flexible in many aspects. The same system could be used to investigate Rubella. In terms of reporting, the disease is reported together with other priority diseases on weekly or monthly basis according to guidelines of the IDSR. The Measles Initiative also noted that vaccination and surveillance activities involving measles are easily integrated with Polio control programmes at the national level for most countries [13]. We were of the view that the MSS was of low representativeness because there was no data contribution from private health facilities. Low representativeness on the other hand, has the potential to derail efforts aimed at eliminating measles by the year 2020. Frantic efforts must therefore be made by stakeholders through persuasive discussions to engage private health facilities to participate in the MSS.

All blood specimen were collected within the thirty-day period counting from the day of onset of rash and fever. This is suggestive of a MSS that is working

to a large extent. However, timeliness of specimen received by the NPHRL to the time of release of report to DSD showed varied outcomes. In 2015 in particular, no report was released to DSD within the stipulated 7 days. The WHO African regional Measles and Rubella surveillance guidelines demand that feedback be given to the DSD within seven (7) days after receipt of blood specimen by the laboratory [8]. This meant that health officials who suspected the case, would be left for a long time without knowing the true status of their case patients. Shortage of measles reagent was the main reason ascribed for this delay in investigating the blood specimen brought to the laboratory. The stability of the MSS is therefore threatened when reagents ran out at the NPHRL and packages for transporting blood specimen are in short supply at the sub-municipal and municipal levels of the MSS. The problem of unavailability or inconsistent internet access at the offices of the regional and national DCOs affected the stability of the system.

Completeness of data over the period with regard to the indication of the date of specimen collection, did not show any clear trend. However, the number of MCIF that were submitted without indication of the vaccination status of the case has taken a downward trend over the last three years of the period under evaluation. This could be indicative of an ever improving performance as far as data completeness is concerned. For most patients whose date of last vaccination could not be ascertained, we realized that they reported to the health facility without their vaccination or Child Health Record Cards (weighing cards). Those aged 16 years and above, did not have vaccination cards or simply could not recollect accurately the information being demanded. But on the other hand, if this is suggestive of the fact that more and more children are getting vaccinated with the measles vaccine, then it is positive for the municipality as a whole. This is because mass vaccination campaign as noted by other researches is key to the measles elimination process of a country [14]. The biological feasibility still remains that measles can be eradicated from all countries of the world in the near future despite the current challenges with funding of measles vaccination campaigns [13]. For this feat to be achieved however, there is the need for improved performance of the MSS, not only in GWM but everywhere in the country and beyond [10].

Limitation

The MSS in GWM did not involve private health facilities. Getting the opportunity to interview those in charge of those facilities to elicit from them their reasons for not participating or otherwise contributing to the system would have been the ideal situation. Their part of the story would have offered readers a more balanced view of the MSS. However, the public health facilities in the municipality are strategically sited to cover all communities concerned. Therefore, without the participation of the private health facilities, the MSS of the GWM could be creditably described as being effective and useful.

Conclusion

Ga west Municipal measles surveillance system is simple, flexible and generally acceptable. It is sensitive, timely, stable but with low representativeness and below-target data quality. It is therefore effective. Municipal health officials have been sensitized on private sector participation and need for quality and timely data.

Recommendations

We recommend that the Municipal Health Management Team (MHMT) should engage heads of private health facilities in the municipality to facilitate their inclusion in the MSS. Also acting through the DCO, the MHMT should ensure that all surveillance officers are properly trained on how to complete MCIFs and the need for quality data at all levels.

Also, the Municipal Assembly should pass appropriate by-laws that require private health facilities to set up disease control units that report directly to the MHD before they are licensed to operate in the Municipality.

Finally, surveillance officers at the Regional and National levels of the MSS should ensure regular and timely feedback to the Municipality to complete the surveillance cycle.

Public Health Action

Municipal Surveillance officers were sensitized on private sector participation and need for complete data.

What is known about this topic

- Measles vaccination prevents about two million deaths annually.
- About 95% of measles deaths occur in developing countries.

What this study adds

- The Measles Surveillance System in Ga West Municipality has good data quality with no discrepancies at any reporting level.
- The Measles Surveillance System in Ga West Municipality is not representative because only public facilities in the municipal report to it.

Competing interests

Authors declare no competing interest.

Authors' contributions

EKT, SA, EK, DKA, SOS conceptualized the plan of the evaluation. EA, SA, DKA participated in data collection and analysis. EKT, SA, EK, DKA, SOS, PN, BCT wrote the report. EKT, SA, EK, DKA, SOS, PN, BCT drafted the manuscript. All authors read and approved of the final version of the manuscript.

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Figures

Figure 1: Map of Ga West Municipality (area bounded by red line)

Figure 2: Trend of Suspected Measles Cases, GWM, 2012 – 2016

Figure 3: Timeliness of suspected measles cases investigated by NPHRL to release of report to DSD, GWM, 2012 - 2016

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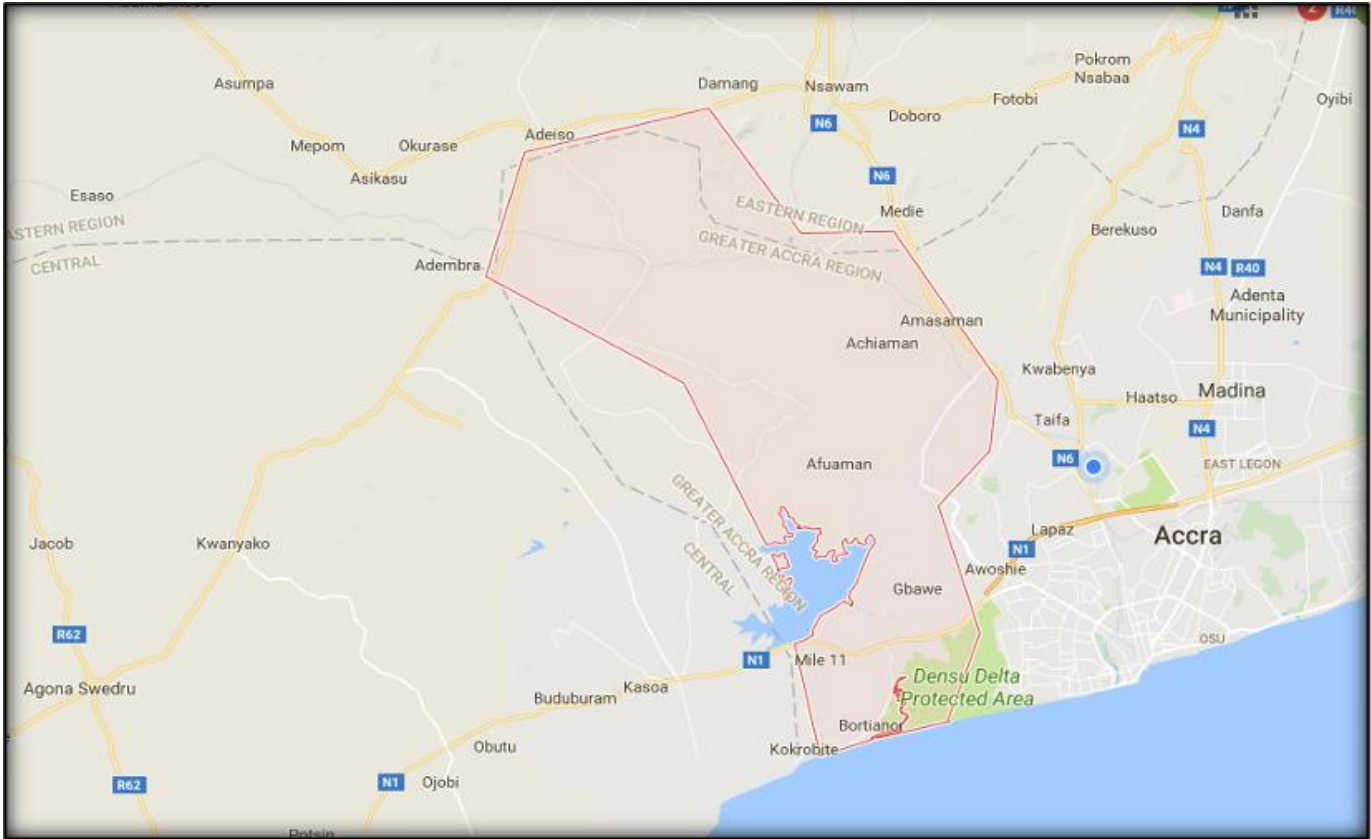


Figure 1: Map of Ga West Municipality (area bounded by red line)

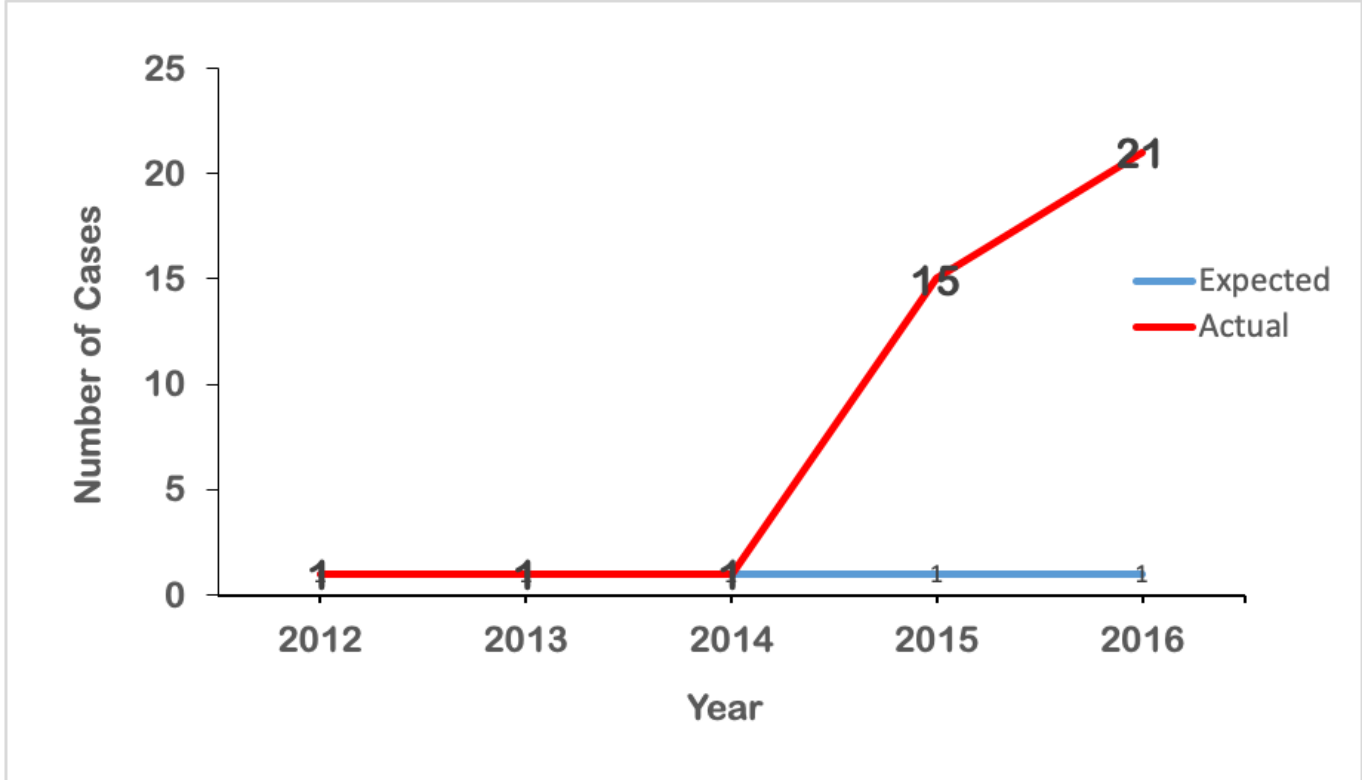


Figure 2: Trend of Suspected Measles Cases, GWM, 2012 – 2016

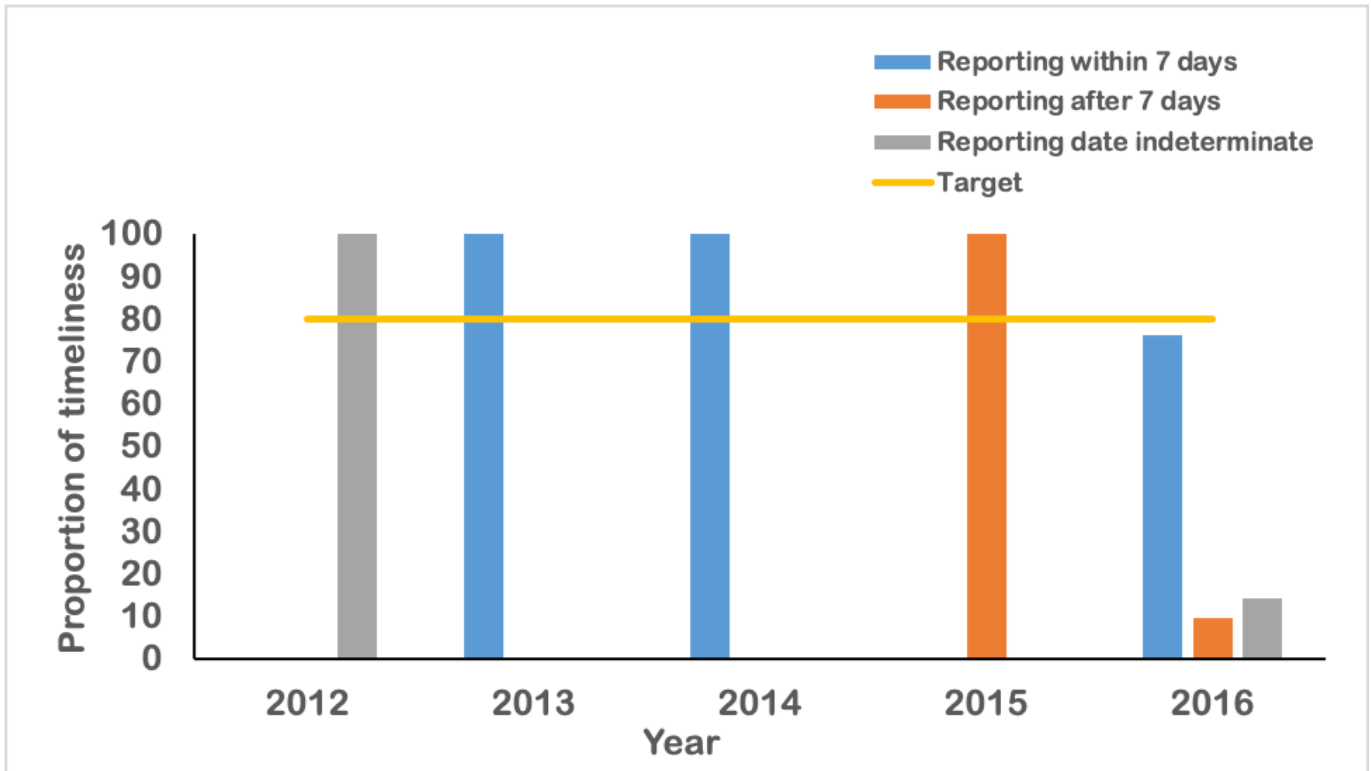


Figure 3: Timeliness of suspected measles cases investigated by NPHRL to release of report to DSD, GWM, 2012 – 2016