# Evaluation of the Pediatric Bacterial Meningitis Surveillance System at Harare Hospital 2015

**T. Tsikira[1], P. Manangazira[2], M. Mungati[1], Bangure D[1], Gombe N[1], Tshumanga[1]**

1. Department of Community Medicine University of Zimbabwe
2. Zimbabwe Ministry of Health and Child Welfare

All correspondence to be addressed to:

T. Tsikira
Department of Community Medicine, University of Zimbabwe
Box A 178
Avondale Harare
Phone: +263771296179
Email: drttsikira@gmail.com

**Abstract**

## Introduction

Paediatric Bacterial Meningitis Surveillance was launched by the World Health Organisation in 2002 at Harare Central Hospital. An Evaluation of the surveillance system at this site was carried out because the site had a poor reporting rate of 13,3% in 2013, there was 50% completeness of the reported cases and there was also 0% culture positivity for Hib against a set target of 20%.

## Methods

A descriptive cross sectional study was conducted using the CDC guidelines for evaluating a surveillance system.

## Results

27 of the 30 health care workers involved in PBM were interviewed. Only 27,6% were aware of the reporting deadlines and 22% had ever notified a case. 63% of the participants thought the system was too long taking at least 30 minutes to fill in.

## Conclusion

Health workers had poor knowledge of the system and they found it to be unacceptable, complex and too long.

## Key words

PBM - Paediatric Bacterial meningitis

Word count-155

## Background

Public health surveillance is defined as the on-going systematic collection, analysis and interpretation of data essential to the planning, implementation and evaluation of public health practice closely integrated with the timely dissemination of these data to those who need to know[1,2].

The above mentioned systems include health facility-based or community based surveillance, sentinel surveillance, laboratory surveillance and disease specific surveillance involving activities aimed at targeting health data for a specific disease[3]. There are more than twenty five public health surveillance systems in Zimbabwe. Sentinel surveillance is a reporting system based on selected institutions or people providing regular reports on specific conditions occurring in a defined population.

Heamophilus influenza type b (Hib) and streptococcus pneumonia infections are responsible for more than half a million deaths under five childhood deaths annually in Sub Saharan Africa[4]. As part of the Global Framework for Immunization, Monitoring and Surveillance (GMFIS), the World Health Organization (WHO), launched the Paediatric Bacterial Meningitis surveillance system (PBM) in 2002. The sentinel surveillance for Hib and Paediatric Bacterial Meningitis in children under 5 is being supported financially by the WHO. The goal of the surveillance system is to provide evidence of Hib and pneumococcal disease burden, generate data on streptococcal pneumonia drug resistance, serotypes and genotypes and evaluate the impact post vaccine introduction. Meningitis has been implicated among the top ten causes of under-five mortality in Zimbabwe[5].

In addition concrete data on the burden of PBM in Zimbabwe is limited thus setting up the surveillance system was necessary. As a result the country decided to commence PBM surveillance. WHO is supporting the Ministry of Health and Child Care (MoHCC) in

Paediatric bacterial meningitis (PBM) surveillance in order to ascertain burden and to produce serotype data for appropriate vaccines[6]. Harare Central Hospital is currently the only sentinel surveillance site for paediatric bacterial meningitis in Zimbabwe. The hospital started PBM surveillance in 2002. The objectives of the PBM surveillance system are to:

1. To measure the impact of Hib and other new bacterial conjugate vaccination programs.
2. To demonstrate the burden of meningitis caused by Heamophilus influenza (Hi*b),* *Streptococcus pneumoniae,* and *Neisseria meningitides* in children less than 5 years of age (0-59 months of age*).*
3. To create data for advocacy for the currently available Hib vaccine and the future conjugate vaccines for *S. pneumoniae* and *N. meningitides*.

A suspected case of pediatric bacterial meningitis in a child 0-59 months of age is defined as: a child 0-59 months hospitalized with signs and symptoms of bacterial meningitis as defined by the pediatrician. Signs and symptoms that may be considered for the diagnosis of bacterial meningitis are, sudden onset of fever (>38ºC axillary) and at least one of the following signs: neck stiffness, bulging fontanel (in children <12 months), poor suckling (in neonates), altered consciousness, irritability, seizures, other meningeal signs, toxic appearance, petechial or pupural rash.

Once a suspected case is identified, a Lumbar Puncture (LP) is performed if the care giver consents. Three CSF specimens are collected and the patient is registered in a Case Log Book with an assigned patient unique ID number using pre-made surveillance labels. The Case Report and the Specimen Collection and Feedback forms are completed using the same unique patient ID number used as the specimen labels. The CSF specimens are then immediately taken to the lab where macroscopic, biochemical, microscopic, culture and sensitivity tests are done to make a confirmed diagnosis. The results are then recorded on the

case log book, and specimen collection and feedback forms. This data is then used by the clinicians to make decisions on appropriate treatment for the patient. The forms are then kept at the health information office for reference by the PBM surveillance team[7].

Harare Central Hospital is the only sentinel site for PBM. It is a teaching hospital that has the largest children's hospital in the country. A review of Harare Central Hospital information records showed that, of the 490 cases of suspected paediatric bacterial meningitis cases seen in 2013, only 65 had surveillance forms filled out. The average completeness of the available forms was less than 50%. There was also a 0% culture positivity of Hib against a target of 20%. This raised concern about the usefulness of the PBM surveillance system in describing disease burden and resistance strains of paediatric Hib and pneumococcal infections and prompted an evaluation of the surveillance system. This study was carried out to evaluate the Pediatric Bacterial Meningitis (PBM) surveillance system at Harare Central Hospital.

## Methods

A descriptive cross sectional study was conducted using the CDC guidelines for evaluating a surveillance system. Health workers involved in PBM at HCH and the National Microbiology Reference Laboratory were interviewed. All 65 records submitted in 2013 were reviewed. Checklists and interviewer guided questionnaires were used to collect data. Quantitative data was analysed using Epi-info while qualitative data was analysed manually for recurring themes and verbatim. Written informed consent was obtained from all participants before the interviews were conducted. Confidentiality of data was assured and maintained throughout the study and afterwards by not recording the names and addresses of the respondents. The information gathered was used only for the purpose of the study.

In the case of refusal to participate in the study, another respondent was selected and there was no negative consequences stemming from the refusal. All records will be returned after completion of the study. The questionnaires were kept under lock and key for future reference and will be destroyed 6 months after completion of the study. Permission to proceed with the study was sought from the MOHCC, Clinical director for Harare Central Hospital, Director of NMRL and Health Studies Office.

## Results

Table 1 shows the demographic characteristics of the study participants. A total of 27 health care workers were interviewed. The majority were female and they were nurses. The median years in service were 4 years.

**System attributes**

**Timeliness and completeness**

Only 8(29,6%) of the 27 of the responders were aware of the correct time of submission of specimen while only one participant was aware of the reporting deadlines for PBM data. All the 65 forms submitted in 2013 were either submitted late or had missing time stamps. Only one form had all fields completely filled in. The average completeness of the available forms was 38%. Data on Laboratory feedback, vaccination status and patient outcome was consistently missing on 64 of the forms.

**Acceptability:**

While all participants claimed that they were willing to participate in PBM and accepted responsibility to participate, this was in contrast to the fact that only 22% had ever notified a case and that the reporting rate was 13%. Reasons cited for this was that 85,1% of

respondents felt that the system did not involve them and was too centralised on the focal persons. Among the study participants, 33.3% of respondents also felt that they needed to get an incentive to fill in the forms as they were comparing the surveillance system to the Rota virus surveillance system which pays out a dollar for every specimen collected. Table 2 shows the study participants responses on Acceptability of the system.

> "we know there is money, they should give us an incentive like the rotar virus surveillance, we will not do extra work for them to eat the money themselves"

**Simplicity:**

Most of the respondents thought that the forms took a lot of time to fill in with 63% of them saying it took at least thirty minutes to fill in. When asked how they would describe the process of notification, 77% described it as simply long. The forms have up to 98 fields that are filled in and they rotate between four different departments, the children's hospital, the clinical laboratories, the national microbiology reference laboratory and the health information office. The data is subsequently sent to the MoHCC and WHO. Follow up analysis is also done at NCD South Africa for serotyping. Table 3 shows responses on time taken to fill in the forms.

**Flexibility**

The system does not notify any other diseases and uses different forms from the routine hospital specimen collection forms. None of the respondents was aware of any changes that had been done to the system. Therefore the system was not flexible.

**Stability:**

Only one health worker had ever been trained in PBM with another one having been inducted without training. There were no case definitions or system protocols readily available in the

ward, casualty or laboratory. It was also noted that the 4 monthly rotations of the SRMOs who had the bulk of the responsibility to collect specimen was a threat to the operation of the system. Of the study participants, 63% of the respondents said the system was not always in place and 94% cited the unavailability of forms as a reason. While there was a functional internet connection at the laboratory and data was being captured electronically, this was not the case at the ward level where data was still captured manually and the health information department had to consolidate these two forms of data to come up with the final case report. Frequent stock outs of sheep agar were reported at the laboratory and this forced subsequent use of human agar. The system is also entirely depended of a fixed budget funding from the WHO. Table 4 shows the study participants responses on training, induction and availability of case definitions.

**Knowledge:**

Respondents demonstrated poor knowledge on the objectives, structure and reporting deadlines of the system. They however, had good knowledge on the case definitions and the type of specimen required for investigation. Table five shows health worker knowledge levels on various aspects of the system.

**Usefulness:**

All participants thought that the system was useful but only one could mention a Public Health action resulting from the system. Data from PBM was however used to initiate the PCV vaccine in 2012. It is also being used to demonstrate the serotypes of Pneumococcal disease in the population and recent trends from the surveillance system has shown that there are particular serotypes that are not covered by the current vaccine, serotype 4 and 15. There is also a decline in the cases of pneumococcal infections being seen since the introduction of

the vaccine which is a crude measure of vaccine efficacy as shown in the figure 1and 2 also shows responses on usefulness of the system.

**Low culture positivity**

The frequent stock outs of media and subsequent use of human blood was cited as one the reasons behind low culture positivity, the ward staff was also not aware of the timeliness for submission of CSF specimen after collection resulting in late submission of specimen. Key informants also indicated that patients were reporting after having presented to clinics and received antibiotics thereby affecting the yield of bacteria upon culturing. These were the three main reasons cited for low culture positivity.

## Discussion

The findings in this study demonstrated that the system is complex, with poor knowledge of the system among health workers. The surveillance system is unstable and unacceptable producing poor quality data.

Health worker knowledge of a surveillance system is prudent if the system is to operate efficiently to produce its desired objectives. There was evidently poor knowledge of health workers on PBM which affects the operation of the system. This is consistent with findings from an evaluation of PBM performance in sub-Saharan Africa that was done by CDC in 2012[1]. The frequent staff rotations makes frequent trainings a pre-requisite if health workers are to be knowledgeable about the system but, this is being compromised by the inadequate funding which makes the target trainings and inductions impossible.

The PBM system at Harare Central Hospital is operating as a stand-alone system in a bigger system, relying on multiple entities that need precise co-ordination. It requires the full commitment of the laboratory, clinical staff and health information department. The flow of

information to and from these different stations is not well understood or coordinated by the participants of the system which makes it complex to operate. The required forms are also serving a duplicate function from the already existing routine specimen collection forms as perceived by the clinical staff, also the information required is perceived to be too much. This undoubtedly makes the system unstable and unacceptable. This was evident from the fact that only 22, 2% of the participants had ever notified a case.

The frequent stock-outs of reagents with subsequent use of human blood agar and the poor specimen handling due to late submission are affecting the culture positivity in the system. This is consistent with an evaluation of PBM that was done for the African region by the World Health Organisation which showed that inadequate resources for culture was one the reasons for failure to meet the culture positivity targets[4].

The system is however of Public health importance because the results it is producing are being used to demonstrate vaccine efficacy and they are also demonstrating strains not covered by the current vaccines.

## Conclusion

We therefore conclude that PBM surveillance is a complex system, not widely acceptable by the participating health workers and is producing incomplete data. There is gross lack of knowledge among health workers on the system with the system lacking adequate funding. There is frequent use of inappropriate reagents and poor specimen handling.

It is however a system of Public Health importance that generates information necessary to demonstrate disease burden and vaccine efficacy. The system has demonstrated a decline in SPN cases and serotypes that are not covered by the currently available SPN conjugate vaccine.

## Recommendations

To the PBM focal team leader, we recommend frequent trainings and inductions, at least 4 trainings per year to match the frequent staff turnover of the Resident Medical Officers. Feedback meetings should be held frequently to increase participation and acceptability of the system.

The WHO Surveillance Officer and the MoHCC- Director EDC should also increase the funding of the system for adequate trainings, meetings and reagents.

The NMRL Director and the Deputy Director Health information officer should also work to abridge and simplify the surveillance forms and try to integrate the system in the already existing structures in the operations of the hospital.

The Clinical Director Harare Central Hospital should encourage health care workers participation in the surveillance system.

## Acknowledgements

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## Competing interests

The authors have no competing interests in the study.

## Author's contributions

The authors had equal contributions to the study.

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**List of Tables**

**Table 1: Demographic characteristics of Respondents, involved in PBM surveillance**

| Variable | Category | Frequency n(%) |
|---|---|---|
| Sex: | Female | 15(55.6) |
| Female | Male | 12(44.4) |
| Designation | Consultants | 1(3.7) |
| | Lab Scientists | 1(3.7) |
| | Lab technicians | 2(7.4) |
| | Registrars | 7(25.9) |
| | SRMOs | 7(25.9) |
| | RGNs | 9(33.3) |

Median age 29 years Q1-27 Q3-30

Median years in service 4 years Q1-2 Q3-5

**Table 2: Acceptability of PBM surveillance system**

| Variable | Frequency n(%) |
|---|---|
| Willingness to participate | 27(100) |
| Ever notified a case | 6(22.2) |
| Responsibility to notify a case | 27(100) |
| Reporting rate | 65(13.0) |

**Table 3: Time taken to fill in PBM surveillance system forms**

| Time to fill forms | Frequency n(%) |
|---|---|
| >10min | 3(13.6) |
| 20min | 5(22.7) |
| 30min | 14(63.6) |

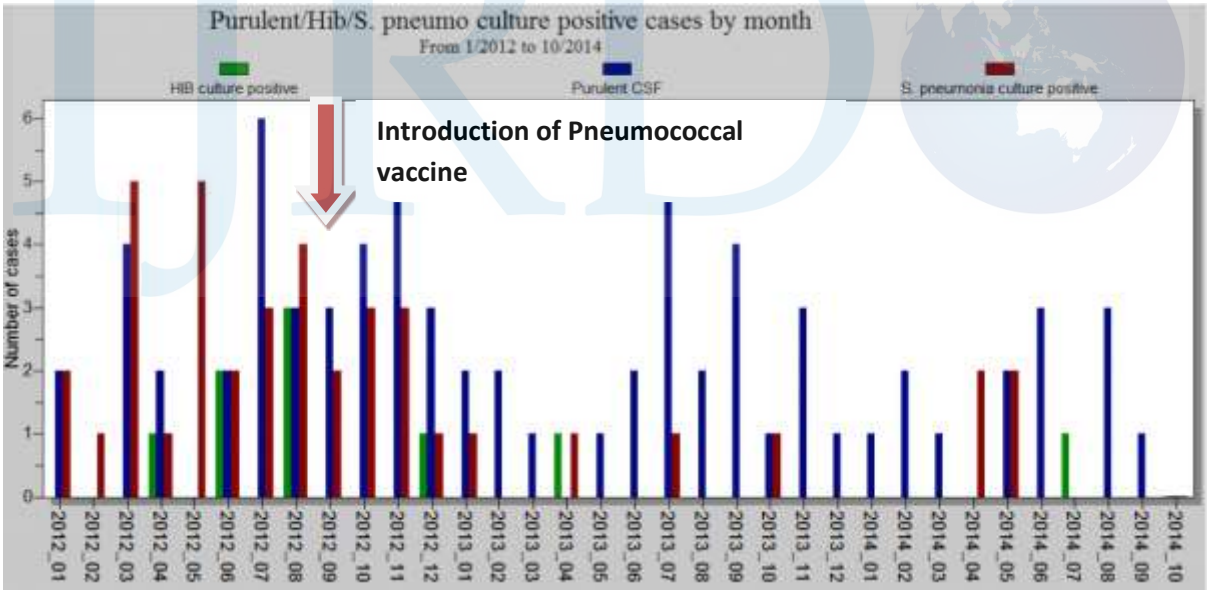
**Table 4: Stability of PBM surveillance system**

| Variable | Frequency n(%) |
|---|---|
| Training in PBM | 1(3.7) |
| Induction in PBM | 2(7.4) |
| Availability of case definitions | 2(7.4) |

**Table 5: Health worker knowledge of PBM surveillance system**

| Variable | Frequency n(%) |
|---|---|
| Correctly stated 2 Objectives of PBM | 10(37.0) |
| Correctly stated reporting deadlines | 1(3.7) |
| Correctly stated PBM structure | 2(7.4) |
| Knowledge of type of forms | 7(25.9) |
| Correctly stated case definitions | 18(66.7) |

**Graph 1: Purulent/Hib/S. Pneumococcal culture positive cases by month**




**Source: NMRL 2014 PBM Report**

**Graph 2: participant's responses on usefulness of PBM surveillance system**