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Philippine Disease Surveillance System

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Abstract:

The concept of disease surveillance was introduced to the public by Alexander D. Langmuir in 1950. Surveillance was defined as, “when applied to a disease, means the continued watchfulness over the distribution and trends of incidence through the systematic collection, consolidation and evaluation of morbidity and mortality reports and other relevant data.” (Langmuir, 1976) Today, in the field of public health, big data analytics and web visualization tools are prevalent in disease surveillance to collect and analyze data, and come up with right decisions and strategies. Being able to manage the acquisition, storage, sharing and utilization of information; and being able to visualize information in an effective manner helps the government to have an effective disease surveillance process. This study aims to incorporate the use of analytics and visualization in the development of a surveillance system for the National Epidemiology Center of the Philippine Department of Health. Health authorities, with the use of the surveillance and analytics systems, will be able to make use of data in their epidemiological planning and strategies. The researchers followed the rapid application development methodology due to its fast development through the accelerated time cycle. After the development of the system, the researchers conduct a User Acceptance Testing (UAT) in order to validate the accuracy and usefulness of the system to its target users. The results of the UAT was promising and additional comments from the respondents have greatly improved the final system.

Key Words: Philippine Disease Surveillance, Analytics, Epidemiology



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1. INTRODUCTION

With the increasing threats about public health being reported around the world, it is necessary that the national government should be proactive in disease surveillance to make the right decisions. In the Philippines, at an average, 500,000 people die every year, where 80% of these deaths is caused by diseases. In this relation, the leading agency for public health in the Philippines, the National Epidemiology Center aims to promote an evidence-based decision making at all levels of the public health systems in terms of disease surveillance, in order to provide information that will be used in epidemiological planning and decision-making for the public health.

The technological investments are then vital to the different aspects of governance, specifically for public health. Such investments help in effective decision-making for the health planning and risk assessment of a nation. In the field of public health, big data analytics and web visualization tools are prevalent in disease surveillance to collect and analyze data, and come up with right decisions and strategies. Being able to manage the acquisition, storage, sharing and utilization of information; and being able to visualize information in an effective manner helps the government to have an effective disease surveillance process.

This research paper presents the design and development of the Philippine Disease Surveillance system for the National Epidemiology Center of the Department of Health. It covers disease surveillance process at a national level - the registration, analysis, and feedback provision of epidemic disease cases. The Philippine Disease Surveillance system aims to facilitate and integrate the disease surveillance process to assist the National Epidemiology Center in monitoring and

analyzing the disease distribution and trends across the archipelago.

2. STATEMENT OF THE PROBLEM

The Epidemiology Bureau has the problem on its inability to create disease surveillance report on a monthly basis that is used for national epidemiological planning and decision making in the Epidemiology Bureau, actually, we are being more aggressive now on data-gathering and timely inputs. The data is very important in so far as planning is concerned. If the data coming in is from one year ago, two years ago, we cannot use that." (Tayag, 2015) The disease surveillance report is heavily based on the surveillance data, and if the data is untimely, the Epidemiology Bureau will not be able to create such report that are used by the Department of Health for making decisions. Such decisions include budget allocation, resource and medicine prioritization, health programs planning, health facility enhancement prioritization, and health staff and practitioner allocation.

Through the interviews, observations and research data gathering on the Epidemiology Bureau and its functions, the research group identified the causes of the problem on its inability to create disease surveillance report monthly by conducting a root-cause analysis using the Ishikawa Problem Analysis Technique as presented in Figure 1.



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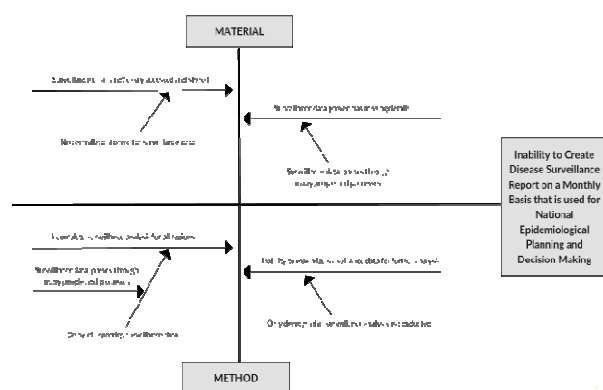


Fig 1 Ishikawa Problem Analysis Diagram

3. METHODOLOGY

The research group adapted the Rapid Application Development methodology for the PDS system as it allows a fast development through the accelerated time cycle. By understanding the risks from the start and determining the roles of each member, this benefit was achieved. Moreover, the methodology was applicable for the development of the PDS system as there were only a few months provided for its development, and user involvement was a priority to ensure that the requirements and design of the system are correct.

The research group analyzed the existing organizational processes, and identified that the National Epidemiology Center has the problem on its inability to create disease surveillance report on a monthly basis that is used for national epidemiological planning and decision making. In the National Epidemiology Center, actually, we are being more aggressive now on data-gathering and timely inputs. The data at NEC is very important in so far as planning is concerned. If the data coming in is from one year ago, two years ago, we cannot use that.” (Tayag, 2015) The disease surveillance

report is heavily based on the surveillance data, and if the data is untimely, the National Epidemiology Center will not be able to create such report that are used by the Department of Health for making decisions. Such decisions include budget allocation, resource and medicine prioritization, health programs planning, health facility enhancement prioritization, and health staff and practitioner allocation.

The system was then tested by the research group after its development. Such process was conducted in order to make sure that the Philippine Disease Surveillance system is aligned to the determined system objectives and requirements, and has been tested for optimal performance. The system was then tested by the users from the National Epidemiology Center. Such process was conducted in order to gather feedback from the organization as to how the system can be improved, and be deployed to its operations. Upon conducting consultations and quality assurance, the Philippine Disease Surveillance system was completely developed to address the problem of the National Epidemiology Center.

4. RESULTS AND DISCUSSION

The research group proposed the Philippine Disease Surveillance (PDS) system that shall help in addressing the problems of the National Epidemiology Center. The PDS System covers the following modules: Registration, Analysis, and Feedback.

The first module focuses on registering the disease cases into the system, which is done by the resident doctors and nurses of the hospitals. This module addresses the problem regarding the accessibility of the surveillance data since the storage of the data becomes centralized, and the delayed reporting of surveillance data. To further address such



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problems, the following features are included, patient and case records management, integration of records, reporting tracker, and alerts and notifications.

The second module focuses on the analysis of the surveillance data, which is used by the national disease surveillance officer. This module addresses the problem regarding the incompleteness of surveillance analytics, and inability to maximize the surveillance data to conduct analysis. To further address such problems, analytical tools and techniques such as slice and dice, drill-down, and statistical forecasting may be used.

The third module focuses on providing feedback on the disease cases, which is used by all the users of the system. This module addresses the problem on the inability to create the monthly disease surveillance report, and the difficulty in making the appropriate national health programs and resource prioritization.

Furthermore, the research group conducted User Acceptance Testing (UAT) with the target users to verify if the developed system functions correctly and meets the requirements of the company. In this stage, the following areas are assessed: functionality, content and information, interface design, security and navigation, and feedback and help. Upon being tested by the development team and the actual users of the system, it has been determined that the Philippine Disease Surveillance System will be able to facilitate and integrate the process of disease surveillance at all levels. It will be able to collect and analyze surveillance data that will provide information useful for national health planning and decision-making. The National Epidemiology Center also believes that the

functions and design of the system provide more capabilities to the organizations. First, the organization will be able to capture surveillance data directly from the disease reporting units (hospitals) that will enable to save time and resources in the process. Second, the organization will be able to have comprehensive disease surveillance analytics with the use of Microsoft Power BI technology that will enable to provide more insights and information. Lastly, the organization will be able to create and store disease surveillance reports that will enable to make national health decisions and strategies. Summary is shown in the table below.

SUMMARY OF RESPONSES
Philippine Disease Surveillance (PDS)
System

FUNCTIONALITY		
#	ITEMS	AVERAGE
1	The system is able to represent the processes of the organization.	4.00
2	The system is able to integrate the registration, analysis, and feedback provision processes of disease surveillance.	4.00
3	The system is able to include all the necessary tasks to perform the registration, analysis, and feedback provision processes of disease surveillance.	3.60
4	The system is able to perform the tasks efficiently and effectively.	4.00
5	The system is able to address	4.00



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	the problem on the inability to create disease surveillance reports on a monthly basis.	
CONTENT AND INFORMATION		
#	ITEMS	AVERAGE
6	The content and information provided are able to help in performing tasks.	4.00
7	The content and information provided are accurate.	4.00
8	The content and information provided are relevant.	4.00
9	The content and information provided are complete.	3.00
10	The content and information provided are updated.	4.00
INTERFACE DESIGN		
#	ITEMS	AVERAGE
11	The layout design of the system is well organized.	4.00
12	The layout space of the system is optimized and maximized.	4.00
13	The widgets used are necessary and appropriate.	4.00
14	The font styles and text are readable and consistent.	4.00
15	The colors used are pleasing to the eyes.	4.00
SECURITY AND NAVIGATION		
#	ITEMS	AVERAGE
16	The system navigation is correct based on the access level of the user.	4.00
17	The system navigation is free from unauthorized access.	3.80
18	The system navigation is able to	3.80

	secure data submitted and processed.	
19	The system navigation is easily accessible.	4.00
20	The system navigation is easily identifiable.	4.00
FEEDBACK AND HELP		
#	ITEMS	AVERAGE
21	The system is able to provide necessary display messages.	4.00
22	The system is able to provide help and instructions.	4.00
23	The system is able to prevent errors.	4.00
24	The system is able to handle errors.	4.00
25	The system is able to recover from errors.	4.00
OVERALL SYSTEM RATING		3.928

GENERAL FEEDBACK AND COMMENTS
Philippine Disease Surveillance (PDS) System

#	FEEDBACK AND COMMENT	USER
1	The system is able to facilitate and integrate the processes of disease surveillance. It can really help the National Epidemiology Center to collect and analyze the surveillance data from the disease reporting units in a much more efficient way. As a recommendation, it would be great if the system will be able to capture the unique data sets of each disease cases to come up with more	Division Head



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	comprehensive data analysis and feedback.	
2	I appreciate the proposed system as it will help us to capture, collect, process, analyze, and use the surveillance data in a timely manner. It will also help in performing the process paperless that will reduce the use of resources, and efforts in manual operations.	Staff
3	Overall, it is a great system. The analytics is very comprehensive and useful. I would like to suggest if there is an option to create customized forms so we can make one for each disease. In this way, the common and unique data variables of each disease can be recorded and processed making the analysis and reports more extensive.	Staff
4	I am now more capable of doing more analysis given the tool. It is very helpful to have the different disease analysis such as correlation, fatality, incidence, and prevalence in order to come up with more valuable insights that can help our decision-makers. I also find the mapping very useful as it allows me to view the disease case not in a city level which makes the analysis more specific.	Staff
5	I can see that the system uses a tool called the Microsoft Power BI. It has great analytical capabilities indeed. However, I am just concerned about the security if we use Microsoft Azure since it is on	Staff

	the cloud. We are very careful with the data we capture and process as these concerns confidential information on the citizens of the country. In general, it is a promising system for us.	
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5. CONCLUSION

In this study, the research group analyzed the existing organizational processes, and identified that the Epidemiology Bureau has the problem on its inability to create disease surveillance report on a monthly basis that is used for national epidemiological planning and decision making. According to our resource person within the center "... actually, we are being more aggressive now on data-gathering and timely inputs. The data is very important in so far as planning is concerned. If the data coming in is from one year ago, two years ago, we cannot use that." (Tayag, 2015). The disease surveillance report is heavily based on the surveillance data, and if the data is untimely, the Epidemiology Bureau will not be able to create such report that are used by the Department of Health for making decisions. Such decisions include budget allocation, resource and medicine prioritization, health programs planning, health facility enhancement prioritization, and health staff and practitioner allocation. Thus, it is vital for the center to process the gathered data immediately in order to ensure its relevance.

The system developed was able to address the inability to create disease surveillance report on a monthly basis that is used for national epidemiological planning and decision making through the processing of collected data as it is received and presenting it in visual form using graphs and analytics.



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