

System Analysis of Public Health Surveillance in School-Age Children

Arief Hargono¹, Kurnia Dwi Artanti¹, Fariani Syahrul¹

¹Faculty of Public Health, Universitas Airlangga, Indonesia

Abstract

School-age children are more susceptible to disease transmission. Health efforts to control health problems are public health surveillance. School institutions have the potential to be the place for conducting surveillance for school-age children, considering that the school institution is a strategic place because its existence will facilitate the outreach of health programs to school-age children. The purpose of this study was to analyze the public health surveillance system for the development of public health surveillance in school-age children. This research was operational research with cross-sectional design. Research variables include data types, data sources, data collection methods, data analysis, health information and information dissemination. Development of a surveillance information system model using the System Development Life Cycle approach. The results of data identification were carried out on the types of data and information that could be monitored and collected by School Health Program teachers and students in schools. The data includes symptoms, immunization data, Adverse Events Following Immunization, student absenteeism and healthy behavior and risk factors for non-communicable diseases. The input entity as a data source is the school and the output entity as the recipient of information is the district/city health office and the education office. Information generated from this surveillance is to complete health program data from health services.

Keywords: *model, information system, surveillance, school-age children, Indonesia*

Introduction

School-age children are an important period in the growth and development of the human body. School-age children are also more susceptible to disease transmission. One health problem that is a priority for school children is an infectious disease that has the potential to become an epidemic, such as measles and diphtheria. Data from the Indonesian Health Profile in 2017 states that measles suspects occur in all provinces in Indonesia and 45% of measles events occur at the age of 5-14 years. Diphtheria incidence at the age of 5-14 years was 46%. Other health problems that have the

potential to occur in children are dengue fever, typhoid, diarrhea, pneumonia and tuberculosis in children.

Various efforts were made by the government to control health problems that occurred. These efforts are reflected in health management in the National Health System which is regulated in the Republic of Indonesia Presidential Regulation Number 72 of 2012 concerning the National Health System. One form of implementation of the health effort sub-system for controlling health problems is public health surveillance. Surveillance is a systematic and continuous analysis of diseases and health problems and risk factors for health problems. The function of surveillance activities is to monitor health problems and evaluate ongoing health programs (Thacker, 2000). Through this surveillance activity, it is expected to be able to monitor disease risk factors so that health problems that occur can be identified earlier.

Health efforts are also carried out in schools through the School Health Program (SHP). The purpose of SHP

Corresponding Author:

Arief Hargono

Faculty of Public Health, Universitas Airlangga

Campus C Mulyorejo 60115

Surabaya-Indonesia,

E-mail: arief.hargono@fkm.unair.ac.id

activities is to early detection of health problems of students and the availability of data and information to assess the health development of students. The SHP activity is a series of activities which include physical examination, laboratory, mental emotional deviation and physical fitness. Data collected in the SHP includes examining general conditions, measuring blood pressure and pulse, nutritional status, teeth and mouth, senses of vision and hearing, laboratory examinations, measuring physical activity and early detection of emotional irregularities.

School institutions are chosen to be the place for conducting public health surveillance for school-age children. School institutions are a strategic place because their existence will make it easier to reach health programs for school-age children. The selection of program implementation in elementary school institutions is expected to reach more children aged 6-15 years to be monitored for their health status.

Public health surveillance is expected to be able to monitor health problems while evaluating ongoing health programs for school-age children. The purpose of this study is to analyze the public health surveillance system for the development of public health surveillance in school-age children.

Method

The research is part of multi-year study for the development of an integrated model of public health surveillance information systems based on community and school. This research is operational research with cross-sectional design. Research variables include data types, data sources, data collection methods, data analysis, health information and information dissemination.

Development of surveillance information system model using the System Development Life Cycle (SDLC) approach. This approach includes system analysis, system design, system implementation, system maintenance and system monitoring and evaluation. The stages of SDLC carried out in this study is system analysis. The system analysis phase identifies the data and information needed for surveillance in school-age children at school.

The study was conducted in Surabaya City, East Java Province. The choice of research location is based on the high prevalence of health problems that occur. East Java Province is the province with the highest number of measles and diphtheria in Indonesia. The research informants came from Surabaya City Health Office and selected institutions for Public Health Center (PHC), Schools and Integrated Service Post for Mother and Child Health (*Posyandu*). Informants in the Surabaya City Health Office consisted of officers of the Surveillance Program, Maternal and Child Health, SHP, and Community Based Health Unit. Informants from the PHC consisted of surveillance officers, Maternal and Child Health, and the person in charge of data and information in the selected PHC. Informants from the school are teachers responsible for SHP. Informants from the *Posyandu* included health cadres in the working area of the selected health center.

Data collection is done by in-depth interviews, document studies and Focus Group Discussion (FGD). Document studies are carried out in the recording and reporting format used in activities related to the ongoing surveillance program at the PHC and schools which includes Maternal and Child Health Program, Immunization, Public Health Surveillance, Environmental Health, Non-Communicable Diseases (NCD) and SHP.

The results of in-depth interviews and document studies will be discussed together in the FGD to agree on the appropriate surveillance information system model. Data collected from in-depth interviews, document studies and FGDs were analyzed descriptively using content analysis.

Results

The development of a system model is a system analysis which is the decomposition of a whole system into its components with the aim to identifying expected data and information needs. The results of the identification of data needed by the system presented in Table 1 to Table 6.

Table 1. List of symptom data needed by the surveillance system

| Data group | Type of Data |
|--------------|---------------------|
| Symptom data | Fever |
| | Cough |
| | Rhinorrhea |
| | Nausea |
| | Vomiting |
| | Diarrhea |
| | Sore throat |
| | Dizziness |
| | Rash |
| | Watery spots |
| | Sprue |
| | Jaundice |
| | Eye pain |
| | Red eyes |
| | Paralyzed |
| | Seizures |
| | Asphyxiate |
| | Epistaxis |
| | Ptechiae |
| | Arthralgia |
| | Dysmenorrhea |
| | Blurred vision |
| | Date of examination |
| | Place |

Table 2. List of immunization and AEFI data needed by the surveillance system

| Data group | Type of Data |
|-------------------------------------|---------------------|
| Immunization of school-age children | Date DT |
| | Measles Rubella |
| | Date Td1 |
| | Date Td2 |
| | Date HPV1 |
| | Date HPV2 |
| | Date TT |
| | Other immunizations |
| | Date |
| AEFI | Reddish |
| | Swelling |
| | Fever |
| | Seizures |

Table 3. List of absenteeism data needed by the surveillance system

| Data group | Type of Data |
|---------------------|--------------------------------|
| Student absenteeism | Date of absence due to illness |
| | Name of disease |

Table 4. List of healthy behavior data needed by the surveillance system

| Data group | Type of Data |
|------------------|--|
| Healthy behavior | Examination date |
| | Height |
| | Weight |
| | Body Mass Index |
| | Wash hands with soap before meals |
| | Wash hands with soap after defecation |
| | Snacking habits |
| | Bring pocket money |
| | Nail conditions |
| | Frequency of toothbrushes daily |
| | Number of teeth cavities |
| | Number of teeth lost |
| | Number of teeth filling |
| | Tartar |
| | DMFT (cavities + missing teeth + teeth filled) |
| | Drug |
| | High risk sexual behavior |

Table 5. List of NCD risk factors data needed by the surveillance system

| Data group | Type of Data |
|-----------------|---------------------------|
| NCD risk factor | Family member with NCD |
| | Type of NCD in family |
| | Smoking |
| | Alcohol consumption |
| | Physical activity |
| | Consumption of fruit |
| | Consumption of vegetables |
| | Stress |
| | Abdominal circumference |

Cont... Table 5. List of NCD risk factors data needed by the surveillance system

| Data group | Type of Data |
|------------|--------------------|
| | Systole |
| | Diastole |
| | Triglycerides |
| | Blood sugar |
| | Cholesterol (HDL) |
| | Cholesterol (LDL) |
| | Gout |
| | Lump in the breast |
| | IVA |

Table 6. List of school environmental data needed by the surveillance system

| Data group | Type of Data |
|----------------------|----------------|
| School environmental | Water source |
| | Clean water |
| | Larvae |
| | Latrine |
| | School canteen |

Result of data identification is carried out on the types of data and information that can be monitored and collected by teachers and students that involved in SHP in school. The data includes symptom data, immunization, Adverse Events Following Immunization (AEFI), student absenteeism and healthy behavior and risk factors for non-communicable diseases (NCD). School environment data is also collected by this system. The school environment data includes the existence of water sources, the availability of clean water, the existence of larvae and the cleanliness of latrines and school canteens.

Data collected by the system is carried out by students appointed as “little doctors” from SHP activities at school. The data was later confirmed by SHP teachers. Data collected is then processed to produce public health surveillance information for school-age children which includes:

Student health status data

Number of students with symptom

Number and characteristics of students with symptom

Number of symptom in students based on frequency and duration

Frequency and duration of student absenteeism

Sickness history of student

Trends in the incidence of symptom in students

Immunization status of students

AEFI incidence in students

Description of healthy behavior in students

Description of NCD risk factors in students

Entities involved in this system model include input entities and output entities. The input entity as a data source is the school while the output entity as the recipient of information is the district/city health office and the education office.

Discussion

Syndromic surveillance refers to the use of pre-diagnostic health indicators to allow timely detection and investigation of potential infectious disease outbreaks¹ as a supplementary approach to routine public health surveillance, by enabling early identification of clusters of illness before confirmatory data are available. Syndromic surveillance can be carried out by the community, for example health cadres, teachers for surveillance at schools, caregiver at daycare centers. All component community who have involved Syndromic surveillance must be trained. It is like research in Malawi. There are Malawi’s CCM (Community Case Management) program. This program is a promising strategy for increasing coverage of sick child treatment. Although there is much room for improvement, especially in the correct assessment and treatment of suspected pneumonia and the identification and referral of sick children with danger signs. However, HSAs (Health Surveillance Assistants) provided sick child care at levels of quality similar to those provided in first-level health facilities in Malawi, and quality should improve if the Ministry of Health and partners act on the results of this assessment². Other research by training health care to found of suspected tuberculosis base on syndrome surveillance³.

School-based surveillance is needed especially in diseases with the highest prevalence at school age. The disease like as Soil Transmitted Helminthiasis⁴ Childhood Obesity⁵, stunting and thinness⁶. School-based surveillance can be done through the School Health Unit Program or through School absenteeism.

School absenteeism is a plausible simple indicator of unusual health evidence within a community especially for age school¹. The indicator such as child-reported fever, reported recent absence from school, absence from school due to illness, or teacher-summarized weekly absenteeism¹.

School absenteeism can detection early warning some outbreaks. Study in China, it can identified the varicella outbreak, mumps outbreak and ILI (Influenza – Like Illness) outbreak⁷. Other research identified syndrome surveillance by some symptoms had found, like as Fever (body temperature higher than 37.5°C or self-disclosure of fever), Diarrhea (\geq three defecations per day), Jaundice (yellow coloration of tissues like skin or pore membrane, abnormal yellowing of tissues), Rash (abnormal changes of the skin, including pruritus and pain), Conjunctiva inflammation (reddened, swollen, and/or burning eyes), Parotid gland inflammation (swelling on the rear side of the earlobe, with fever and local ache when opening mouth or chewing) and Vomiting (and associated headache and abdominal pain)⁸.

Research trials have been conducted by recording school reporting through student data coming to the School Health Unit and School absenteeism. The most common complaints were colds (38.5%), cough (27.4%) and dizziness (25.8%)⁹. Fever is the common sign for School absenteeism. Study in Thailand found that 74% were absence due to sickness with fever¹⁰ Beside that this surveillance can showed that some student with absence due to sickness were significantly ($p = 0.01$) to have fever during rainy season (81.00%) than during the other seasons (winter = 62.84% and summer = 70.56%)¹⁰.

In addition to other data surveillance syndromes related to potential disease outbreaks such as immunization, healthy behavior, it possible to detect risk factors related symptoms⁹. Food insecurity has been shown to be a determinant of school absenteeism and attainment in Ethiopia¹¹. Study in Indonesia said that Hepatitis A outbreak in high school at Lamongan

District can be identified by the risk factors such as contact history with patients, eating habits together in same place, mutual exchange and sharing same eating utensils, the lack of hygiene habit (such as washing hands with soap for students and food handlers), lack of hand washing facilities, bad sanitation, bad food hygiene management, and inadequate clean and hygienic water source¹².

The usefulness of the system would be dependent on motivation of the school director and teachers to collect and assess absenteeism data, and report to health extension workers when increases occur. No thresholds would be assigned to schools, but it would be the responsibility of the school director to determine when absenteeism becomes unusual and to alert the health extension workers¹. School administrator and local teacher should be increasing awareness syndromic surveillance. It is important to could speed up the response time to signal about outbreak⁷.

The potential for recording reports carried out in schools can complement the health data, which has not yet been recorded. Electronic recording can make it easy to record, track and analyze system surveillance. The electronic health record is a cost-effective, promising tool for syndromic surveillance⁵. This system can be used as cohort recording to monitors symptoms of disease as an early detection of infectious disease and potential outbreaks in school students.

Conclusion

Public health surveillance at school-age children conducted in schools is expected to be able to monitor early illness in students. The data includes symptom data, immunization data, AEFI, student absenteeism, healthy behavior and NCD risk factors. The data is strategic for early detection of disease and monitoring health status in students. This surveillance implementation can be carried out by students and teachers who have implemented the School Health Program. Information generated from this surveillance was reported to the health office and the education office to complete health program data from health services.

Conflict of Interest: Nil

Source of Funding: Nil

Ethical Clearance: Health Research Ethics

Committee, Faculty of Public Health, Universitas Airlangga, number 432-KEPK.

References

1. Ashton RA, Kefyalew T, Batisso E, Awano T, Kebede Z, Tesfaye G, et al. The usefulness of school-based syndromic surveillance for detecting malaria epidemics : experiences from a pilot project in Ethiopia. *BMC Public Health*. *BMC Public Health*; 2016;16(20):1–13.
2. Gilroy KE, Callaghan-koru JA, Cardemil C V, Nsona H, Amouzou A, Mtimuni A, et al. Quality of sick child care delivered by Health Surveillance Assistants in Malawi. *Health Policy Plan*. 2013;28:573–85.
3. Wahyuni CU, Artanti KD. Health Cadre Training for Suspected Tuberculosis Case Detection. *J Kesehat Masy Nas*. 2013;8(2):85–90.
4. Belizario VY, Isidore F, Totañes G, Leon WU De, Ciro RNT, Lumampao YF. Sentinel Surveillance of Soil- Transmitted Helminthiasis in Preschool-Aged and School- Aged Children in Selected Local Government Units in the Philippines : Follow-up Assessment. *Asia Pacific J Public Heal*. 2015;27(2):NP1604-NP1615.
5. Flood TL, Ying-QiZhao, Tomayko EJ, Tandias A, Carrel AL, Hanrahan LP. Electronic Health Records and Community Health Surveillance of Childhood Obesity - ScienceDirect. *Am J Prev Med*. 2015;48(2):234–40.
6. Tariku E, Abebe G, Melketsedik Z, Gutema B. Prevalence and factors associated with stunting and thinness among school-age children in Arba Minch Health and Demographic Surveillance Site , Southern Ethiopia. *PLoS One*. 2018;13(11):e0206659.
7. Fan Y, Yang M, Jiang H, Wang Y, Yang W, Zhang Z, et al. Estimating the Effectiveness of Early Control Measures through School Absenteeism Surveillance in Observed Outbreaks at Rural Schools in Hubei , China. *PLoS One*. 2014;9(9):e106856.
8. Pilot E, Schwarz C, Li W, Krafft T. Syndromic Surveillance : Enhancing Detection of Disease Outbreaks in Urban. 2014;(September).
9. Hargono A, Azizah, Artanti KD, Lestari KS. The Epidemiology Surveillance Model of Diphtheria in School Children Based on System Dynamics Analysis. *Surabaya*; 2013.
10. Taweeseenepitch K, Kaewkungwal J, Singhasivanon P, Liulark W, Jittamala P, Khamsiriwatchara A, et al. Patterns of School Absenteeism Among Primary School Students in Bangkok, Thailand. *Southeast Asian J Trop Med Public Heal*. 2018;49(1):143–54.
11. Belachew T, Hadley C, Lindstrom D, Gebremariam A, Lachat C, Kolsteren P. Food insecurity, school absenteeism and educational attainment of adolescents in Jimma Zone Southwest Ethiopia: a longitudinal study. *Nutr J*. 2011;10(29).
12. Harisma FB, Syahrul F, Mubawadi T, Mirasa YA. Analysis of Hepatitis A Outbreak in SMA X Lamongan District in 2018. *J Berk Epidemiol*. 2018;6(2):112–21.
13. Thacker SB. History of Public Health surveillance, in: Teutch, SM, RE, Churchil (eds): *Principle and Practice of Public Health Surveillance*. 2000.
14. Ministry of Health Republic of Indonesia. *Indonesian Health Profile in 2017*. 2018
15. Ministry of Law Republic of Indonesia. Regulation Number 72/2012 concerning the National Health System. 201

