Surveillance for Severe Acute Respiratory Infection as one approach to enhance Global Health Security in Indonesia

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Abstrak

***Latar Belakang**: Sistem surveilans nasional untuk infeksi saluran pernafasan akut berat (SARI) dapat memberikan informasi penting tentang sirkulasi virus influenza, menyediakan sistem untuk mengendalikan kejadian luar biasa yang mengancam keamanan dan keselamatan masyarakat serta menyediakan data untuk sistem surveilans influenza global (GISRS). Kemampuan Indonesia untuk mendeteksi dan mengendalikan penyakit menular penting untuk keamanan kesehatan dunia. Penelitian ini bertujuan untuk menilai sistem surveilans ISPA berat Indonesia (SIBI) dan pemanfaatan untuk memantau patogen prioritas lainnya sebagai upaya meningkatkan keamanan kesehatan global.*

***Metode**: penilaian atribut surveilans melalui review laporan, analisis data dan interview staff yang terlibat dalam sistem surveilans. Semua kasus yang memenuhi kriteria SARI pada bulan Mei 2013 – April 2015 ikut serta dalam penelitian. Data epidemiologi dan virologi dianalisis. Kelengkapan dan kemudahan sistem untuk mencapai tujuan surveilans influenza dan mendukung surveilans penyakit infeksi baru (emerging) dikaji.*

***Hasil**: Sebanyak 1,806 kasus SARI dan 1,697 (94%) spesimen dilakukan pemeriksaan virus influenza. Sebanyak 200 (12%) positif influenza, terdiri dari 46% influenza A(H3N2), 18% A(H1N1)pdm09 dan 37% influenza B. Hasil penilaian terhadap sistem surveilans didapatkan kesesuaian pelaksanaan untuk semua atribut surveilans melebihi target >80%, kelengkapan laporan online 95%, kesesuaian kasus terhadap definisi kasus 100%, kasus yang diambil spesimen 94% dan hasil laboratorium diinput ke database secara online 100%. Sistem surveilans untuk dengue dan infeksi arbovirus lainnya sudah terlaksana di unit rawat jalan dan gawat darurat di sentinel SARI surveilans.*

Kesimpulan**: SIBI dapat disesuaikan untuk menggabungkan surveilans penyakit lain yang menunjukkan kegunaan dan fleksibilitas dalam mendukung keamanan kesehatan global.* ***(Health Science Journal of Indonesia 2018;9(1):8-13)

***Kata kunci**: keamanan kesehatan global, surveilans, influenza, Indonesia*

Abstract

Background: The existing national surveillance system for severe acute respiratory infection (SARI) provides critical information on influenza virus circulation, provides a system to control influenza outbreaks that threaten the safety and security of the population and feeds data into the global influenza surveillance and response system (GISRS). Indonesia's ability to detect and control communicable diseases is critical for global health security. The aim of this study was to assess the SARI surveillance system and utility for monitoring other priority pathogens as an effort to enhance global health security.

Methods: Surveillance attributes were assessed by reviewing records, data analysis and through interviewed with staffs involved in the surveillance system. All patients at six sentinel hospitals who meet the SARI case definition during May 2013 – April 2015 were enrolled. Epidemiological and virological data were analyzed. The surveillance system utility for its influenza surveillance objectives and flexibility to support surveillance of emerging infectious diseases were assessed.

Resuts: A total of 1,806 SARI cases were reported of which 1,697 (94%) had specimens tested for influenza viruses. Of those tested, 200 (12%) were positive, of which 46% were influenza A(H3N2), 18% A(H1N1)pdm09 and 37% influenza B viruses. The system exceeded the targets of >80% adherence for most attributes: 95% for completeness of online reporting, 100% for cases adhering to the case definition, 94% for cases with specimens collected and 100% of laboratory results uploaded to the online database. A surveillance system for dengue and other arbovirus infections was established in the outpatient/emergency units at the SARI surveillance sentinel.

Conclusion: SIBI was adjusted to incorporate surveillance for other priority diseases indicating its utility and flexibility to support global health security. ***(Health Science Journal of Indonesia 2018;9(1):8-13)***

Keywords: Global Health Security, surveillance, influenza, Indonesia

As the world's fourth most populous country and with increasing international travel and trade, Indonesia's ability to detect and control communicable diseases is critical for global health security.[1-3] The existing national surveillance system for severe acute respiratory infection (SARI) provides critical information on influenza virus circulation, provides a system to control influenza outbreaks that threaten the safety and security of the population and feeds data into the global influenza surveillance and response system (GISRS).[4]

To learn how Indonesia's SARI surveillance system might serve additional surveillance functions such as monitoring for emerging infectious diseases, its utility and flexibility was evaluated. Indonesia's SARI surveillance system, *Surveilans Infeksi Saluran Pernapasan Akut Berat Indonesia* (SIBI) was established in May 2013 in accordance with the World Health Organization's (WHO) influenza surveillance standards.[5] Sites were established at inpatient wards in four district and two provincial hospitals that were geographically dispersed (Figure 1).[6] The aim of this study is to enhance global health security, countries might consider adjusting existing surveillance systems to detect other priority pathogens.

METHODS

Nasal and throat swabs were collected and a questionnaire for clinical and demographic variables was administered from all patients that meeting the SARI case definition according to WHO influenza surveillance guideline.[5]

The SIBI's utility for its influenza surveillance objectives and flexibility to support surveillance of emerging infectious diseases were assessed in May 2015, 2 years after the system was established (Table 1).[7] Utility was assessed by determining if (1) the system outputs were fulfilling the system's stated objectives and (2) the system processes were meeting surveillance attribute targets (Table 1). Flexibility was assessed by determining whether the system's data collection and analyses could be modified for surveillance of emerging infectious diseases including MERS CoV and dengue. SIBI's guideline, monthly bulletins, quarterly site-monitoring visit reports, and surveillance data for May 2013 - April 2015 were reviewed for supporting evidence.[8]

This study was reviewed and approved by Ethical Clearance Committee of National Institute of Health Research and Development (NIHRD), Ministry of Health of Indonesia (No. LB.02.01/5.2/KE.198/2013 for 2014, LB.02.01/5.2/KE.324/2015 for 2015).

RESULTS

Utility

Surveilans Infeksi Saluran Pernapasan Akut Berat Indonesia addressed all of its stated objectives (Table 1). In May 2013 – April 2015, a total of 1,806 SARI cases were reported of which 1,697 (94%) had specimens tested for influenza viruses. Of those tested, 200 (12%) were positive, of which 46% were influenza A(H3N2), 18% A(H1N1)pdm09 and 37% influenza B viruses. Detailed clinical and epidemiological findings for both SARI and influenza cases were reported in the SIBI monthly bulletin (Table 2).[8] Data on underlying medical conditions and patient outcomes can be used to identify risk groups for future preventive measures including vaccination.[9]

The system exceeded the targets of >80% adherence for most attributes: 95% for completeness of online reporting, 100% for cases adhering to the case definition, 94% for cases with specimens collected and 100% of laboratory results uploaded to the online database. The timeliness of each site's online reporting of cases increased over time but only 14-52% of cases were reported by the targeted Monday midnight deadline. The key challenges for prompt online reporting of cases include the availability of internet connection in rural areas and the availability of administrative staff for data upload.

Flexibility

Even though SIBI was established with the objective of conducting routine influenza surveillance, it demonstrated flexibility to incorporate surveillance of emerging infectious diseases including MERS CoV and novel influenza A(H7N9) virus. This flexibility was a result of adjusting two aspects of the system in December 2013: (1) updating variables collected to include travel history, and (2) adjusting the laboratory testing algorithm so that SARI cases with travel history to affected countries could be tested for MERS CoV or A(H7N9) virus infection. SIBI's capacity to test for emerging infectious diseases especially for MERS CoV was critical because approximately 1.2 million Indonesians undertake pilgrimage to Saudi Arabia each year and the risk of virus introduction was deemed high.[10,11] Within 3 weeks of adjusting SIBI, the first suspect case of MERS CoV was detected and tested negative.

By May 2015, 21 cases of suspected MERS CoV were detected by SIBI and all tested negative. At each adjustment of SIBI, the Ministry of Health provided refresher training, monitoring, and updated guidelines to the sentinel sites to ensure that case enrolment, questionnaire administration, specimen collection, and reporting were correct.[12]

In 2014, as a result of improved performance on surveillance system attributes, a further innovation was introduced at each hospital site. A surveillance system for dengue and other arbovirus infections was established in the outpatient/emergency units. This system, known as *Sistem Surveilans Sentinel Dengue*, was established in September 2014 and provides data on regional dengue serotype trends and patient clinical presentation. SIBI and *Sistem Surveilans Sentinel Dengue* enable cost efficiency as specimens are shipped together (from sites up to 1500 miles away) to the Ministry of Health laboratory and the administrative resources are shared.[13] This innovation was based on the WHO influenza standards that recommended introduction of surveillance for other priority syndromes at SARI hospital sites.[4]

Table 1. Evaluation methods and findings for SIBI assessment, May 2013 – April 2015

Evaluation question	Evaluation method	Findings
I. Utility: A) Does the system address its stated objectives to identify: 1. SARI and influenza disease trends 2. Influenza virus subtypes and characteristics 3. Severity of SARI and influenza cases.	Review of SIBI outputs for May 2013-April 2015 using SIBI website and monthly bulletins.	1. 1,806 SARI cases (1% of total hospitalizations), 988 (55%) of patients were male; 82% aged ≤15 years; 37% of SARI cases and 40% of positive influenza cases were in age group 1-4 years. The highest proportion (44-50%) of positive influenza cases per week occurred in weeks 2 to 3 in 2014. 2. 200 (12%) SARI cases were influenza positive: subtype A(H3N2) (46%), A(H1N1) pdm09 (18%) and B (37%). Virus sequences uploaded on international databases GISAID and FluNet. 3. Pneumonia was found in 27% of SARI cases, and 15% of influenza positive cases. Case fatality ratio for SARI 2% (n=40) and for influenza positive 1% (n=2).
B) Does the system perform according to surveillance attribute targets?	Surveillance targets: a) Completeness of data in SIBI database: ≥80% of case forms have complete data. b) ≥80% of SARI cases adhere to the prescribed WHO case definition. c) ≥90% of SARI cases have specimens collected for diagnostic testing. d) ≥80% laboratory results uploaded to their case forms online in the system database. e) ≥80% of cases uploaded to the online database by midnight each Monday.	a) 95% of SIBI case reports have complete data. b) 100% of cases adhere to prescribed case definition c) 94% of cases have specimens collected. d) 100% laboratory results were uploaded to online database. e) In 2013: 14% cases uploaded by Monday midnight (hospital range 4-31%); in 2014: 52% (hospital range 9-88%); In January-April 2015: 52% (hospital range 32-92%).
II. Flexibility: Can the system be adjusted for surveillance of emerging infectious diseases?	Evidence of flexibility in updating: a) Data variables collected. b) Algorithm for laboratory diagnostic testing. c) Surveillance for other priority syndromes introduced.	a) Travel history variable added 6 months after system started. b) SARI cases with travel history to A(H7N9) virus and MERS CoV affected countries could be tested for these diseases. *c)* *Sistem Surveilans Sentinel Dengue* was introduced to monitor Dengue serotype distribution and trends, and then expanded to include surveillance for other arboviruses including Chikungunya and Zika.

Abbreviations: SARI=Severe acute respiratory infection; GISAID=Global Initiative on Sharing Avian Influenza Data, MERS CoV=Middle East Respiratory Syndrome Coronavirus.

Table 2. Characteristics of SARI and influenza-positive cases at six surveillance hospitals, May 2013 – April 2015

	SARI cases (N=1806) n (%)	Positive Influenza (N=200) n (%)
Gender		
Male	988 (55)	110 (55)
Female	818 (45)	90 (45)
Age group (yrs)		
<1	506 (28)	24 (12)
1 – 4	676 (37)	80 (40)
5 – 14	296 (17)	43 (22)
15 – 49	167 (9)	18 (9)
50 – 64	102 (6)	22 (11)
≥65	59 (3)	13 (7)
Symptoms*		
History of fever	1804 (100)	200 (100)
Temperature ≥38°C	1139 (63)	143 (72)
Cough	1800(100)	200 (100)
Sore throat	439 (24)	74 (37)
Difficulty breathing	916 (51)	83 (42)
Vomiting	675 (37)	80 (40)
Pleuritic chest pain	222 (12)	31 (16)
Rhonchi	738 (41)	64 (32)
Diarrhea	355 (20)	36 (18)
Medical condition*		
Smoker	117 (7)	23 (12)
Asthma	105 (6)	21 (11)
Neurological disorder	12 (1)	1 (1)
Pregnancy	5 (0.3)	0 (0)
Diabetes	35 (2)	5 (3)
Chronic kidney disease	6 (0.3)	2 (1)
Tuberculosis	40 (2)	5 (3)
Cardiovascular disease	24 (1)	5 (3)
Chronic obstructive pulmonary disease	44 (2)	12 (6)
Immunosuppression	3 (0.2)	0 (0)
Chronic liver disease	2 (0.1)	0 (0)
Blood disorder	4 (0.2)	1 (1)
Influenza vaccination	9 (1)	2 (1)
Cancer	3 (0.2)	0 (0)
Obesity	12 (1)	2 (1)
Discharge condition		
Death	40 (2)	2 (1)
Radiologic examination		
Chest radiograph obtained	697 (39)	58 (29)
Pneumonia on chest radiograph	480 (27)	30 (15)
Symptoms as per IMCI for children aged <5 years*	**SARI Cases (N=1,182) n (%)**	**Influenza Positive (N=104) n (%)**
Chest indrawing	246(19)	10 (10)
Unable to drink	69 (6)	3 (3)
Convulsion	159 (13)	21 (20)
Stridor	70 (6)	4 (4)
Lethargy/ reduced consciousness	31 (3)	2 (2)

Abbreviation: IMCI = Integrated Management of Childhood Illness
*Patient might have more than one symptom/condition

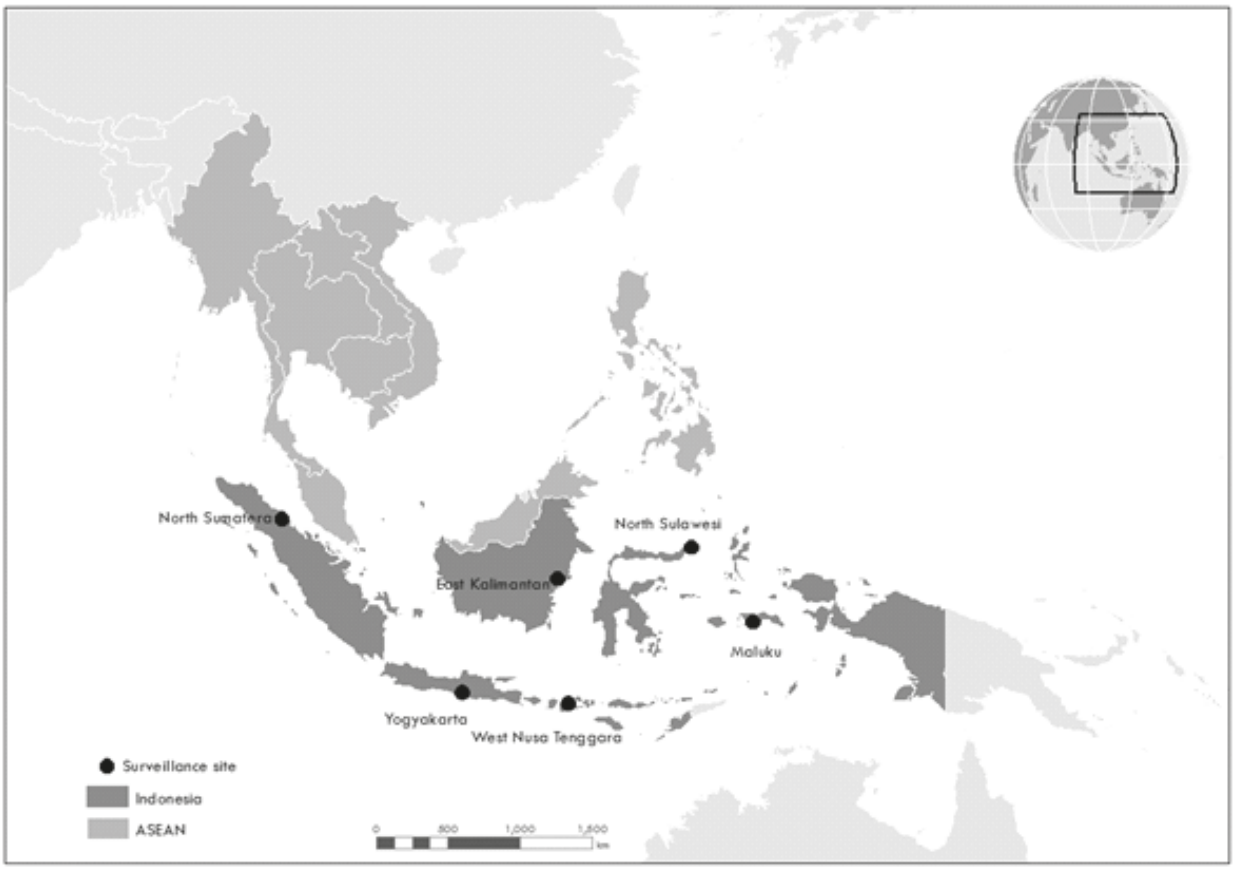

Figure 1. Sentinel site of Surveillance ISPA BERAT Indonesia (SIBI)

DISCUSSION

The SIBI has operated for over three years in Indonesia and yields high quality data from geographically dispersed hospitals. However, as the system is relatively new and timeliness of online case reporting is still below target, there is a need to continually strengthen its operation. With only six sites, SIBI cannot replace nationwide indicator or event-based surveillance systems for the detection of emerging infectious diseases such as MERS CoV. However, SIBI serves as a second line of defense for the detection of newly emerging diseases as sites are actively searching for patients meeting the case definition. As SIBI operates year-round, it helps maintain the continuous operation of surveillance capacities such as laboratory diagnostic skills, specimen collection supplies, supply management and specimen shipment chains. This enhances Indonesia's readiness for emerging infectious diseases and other disease threats.

This evaluation, in context of the system's utility and flexibility to address global health security needs, found that SIBI is highly valuable in addressing the current objectives for influenza surveillance as well as flexible for incorporating surveillance for other emerging infectious diseases. Future SIBI enhancements envisioned include work on other vaccine-preventable illnesses, including pneumococcal disease and respiratory syncytial virus infection, to provide baseline data for programmatic and policy decision-making.

For global health security, it is important for countries to increase disease surveillance capacities, including surveillance for emerging infectious diseases. Indonesia's success is critical as it is the world's fourth most populous country that spans over 3000 miles (5000 km) with increasing international travel and trade. Indonesia's severe acute respiratory infection surveillance system (SIBI), which focuses on influenza surveillance, was evaluated to assess its broader surveillance flexibility.[12,14]

SIBI successfully addressed the current influenza surveillance objectives, by exceeding 4 of 5. By adding additional variables and testing algorithms, it was sufficiently flexible to incorporate surveillance

for other emerging infectious diseases such as Middle East Respiratory Syndrome Coronavirus.[15] The inpatient system for influenza was also augmented by an outpatient surveillance system for dengue to increase cost efficiency.

In conclusion, The existing surveillance systems can be adjust to detect other priority pathogens and enhance global health security. Indonesia is investing in geographically-dispersed surveillance sites to generate high quality data that can inform various disease control programs.

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