Effects of climate change on the distribution of influenza virus in Indonesia in 2012-2013

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Abstrak

Latar belakang: *Influenza merupakan penyakit yang terjadi sepanjang tahun di Indonesia. Surveilan ILI (Influenza-Like Illness) telah berlangsung sejak tahun 2006, akan tetapi informasi mengenai pengaruh perubahan iklim terhadap distribusi virus influenza di Indonesia masih terbatas. Penelitian ini bertujuan untuk mengetahui pola distribusi influenza akibat perubahan iklim di Indonesia pada tahun 2012-2013.*

Metode: *Penelitian ini menggunakan data surveilan ILI pada tahun 2012-2013. Semua sentinel ILI dibagi berdasarkan zona hujan (regional A, B atau C). Data kasus ILI dianalisa berdasarkan distribusi kasus positif influenza per bulan pada tiap regional.*

Hasil: *Kasus positif influenza pada tahun 2012 sebanyak 858 (22,4%) dan sebanyak 624 (23,3%) pada tahun 2013. Kasus influenza di Indonesia pada tahun 2012-2013 berfluktuasi setiap bulannya mengikuti pola hujan.*

Kesimpulan: *Pola distribusi kasus ILI berbeda untuk setiap regional sesuai dengan pola hujan yang ada di daerah tersebut. (**Health Science Indones 2014;2:-**)*

Kata kunci: *influenza, surveilans ILI, pola hujan, iklim tropis, Indonesia*

Abstract

Background: Influenza is a disease that occurs throughout the year in Indonesia. Surveillance of ILI (Influenza-Like Illness) has been ongoing since 2006, but information on the effect of climate change on the distribution of influenza virus in Indonesia is still limited. This study aims to determine the distribution pattern of influenza due to climate change in Indonesia in 2012-2013.

Methods: This study used ILI surveillance data for year 2012-2013. All sentinel ILI divided by rainfall zones (region A, B or C). ILI case data were analyzed based on the distribution of positive cases of influenza per month in each region.

Results: The positive case of influenza in 2012 was 858 (22.4%) and 624 (23.3%) in 2013. The case of influenza in Indonesia in 2012-2013 fluctuated each month following the rain patterns.

Conclusions: The pattern of distribution of ILI cases are different for each region according to the rainfall pattern in the area. (*Health Science Indones 2014;2:-*)

Key words: ILI surveillance, rainfall patterns, tropical climate, Indonesia

Worldwide, influenza epidemics occur yearly with the incidence of 5-10% in adults and 20-30% occur in children. Approximately 3-5 million cases of severe influenza occurs throughout the world and resulted in about 250,000 to 500,000 deaths.[1] Influenza has seasonality pattern in accordance with the increase of influenza incidence in winter (around December to April) in the northern hemisphere and from June to September in the southern hemisphere.[2] In tropical and subtropical regions, the increase of influenza incidence is associated with rainy season as showed in some countries of Southeast Asia and tropical countries in Africa and in the Americas. [3-7]

Indonesia is flanked by two continents and two oceans. Indonesia is on the equator, making Indonesia as a tropical country, which characterized by a similar period of rainy and dry season. As the position of Indonesia is located between two continents and two oceans, Indonesia is vulnerable to climate change impacts in which Indonesia's monsoon could be affected by global climate then further affecting its future climate.[8]

Climate change has a huge impact in a variety of sectors. Indonesia has experienced climate change which resulted in the problem of predicting seasonality. The most influential climate changes indicators are changes of precipitation and surface temperature, extreme weather and climate events, the rising sea level, and changes in sea surface temperature.[8] The Meteorology, Climatology and Geophysics Bureau (BMKG) observation data reported that climate change in Indonesia marked by changes in weather patterns per season-zone in Java and Sumatra.[8]

Climate change is directly related to changes in environmental conditions. Climate and weather patterns are the physical components of an ecosystem. If there are some changes in the physical components of the ecosystem, it will have an effect on the incidence and pattern of spread of the disease.[9] Changes in extreme weather caused by the El-Nino Southern Ossillation (ENSO) may increase the incidence of malaria, dengue, diarrhea, cholera and other diseases transmitted by vectors.[10]

In tropical countries such as Indonesia, influenza is one of the diseases that occur throughout the year with a peak during the rainy season.[11] Information on the impact of climate change on the incidence of influenza in Indonesia is still very limited. Meanwhile, the ability of influenza viruses to mutate easily and quickly is making us to be aware of the occurrence of an influenza pandemic.[12]

This study aims to gain an overview of the distribution pattern of influenza due to climate change in Indonesia.

METHODS

This study used ILI surveillance data in 2012-2013 from 30 sentinel sites in 2012 and 24 sentinel in 2013. There were slight differences in the definition of ILI cases in 2012 and 2013. ILI case definition used in 2012 were outpatients at the health center with the criteria of fever $\geq$ 38 ˚C and a cough or sore throat with onset <7 days and not diagnosed as other diseases.[13] While ILI case definition used in 2013 were outpatients at the health center with the criteria of fever $\geq$ 38 ˚C and cough with onset <7 days and was not diagnosed as other diseases.[14]

Sampling was performed at working day of health center. Respondents who met the criteria for ILI should require approval by signing the informed consent. After that, throat and nasal swab were collected. Specimens were put in viral transport medium (VTM) and stored at refrigerated temperatures between 2-8º C before it sent to regional laboratories and Virology laboratory, Center of Biomedical and Basic Technology of Health in accordance with specimen delivery procedure.[15] The specimens examination conducted by the regional laboratories which then later confirmed by the Virology laboratory, Center of Biomedical and Basic Technology of Health according to the CDC protocol.

All sentinel ILI classified into 3 groups (region A-yellow, region B-green, and region C-red) in accordance with the pattern of rainfall in the region (Figure 1). Monsoon rainfall patterns (Regional A) is characterized by a rainy season in the months from November to March. Equatorial rainfall pattern (regional B) is characterized by a rainy season in October-November and March-May, while local rainfall patterns (region C) is characterized by a rainy season in June-July.[16,17] In 2012, the regional A consists of 24 sentinels, regional B consists of 5 regional sentinels and C consist of one sentinel. Whereas in 2013, the regional A consists of 21 sentinels, regional B consists of 4 sentinels and regional C remains one sentinel (Table 1).

The data used in this study is the number of ILI cases per month from each sentinel and influenza examination results. Monthly number of influenza positive cases from each sentinel was calculated in percent and grouped by rainfall zone (regional A, B or C).

Table 1. ILI surveillance sentinel by region

region	year	study sites
A	2012	24 sentinels
	2013	21 sentinels
B	2012	5 sentinels
	2013	4 sentinels
C	2012 – 2013	1 sentinel

The number of ILI cases in 2013 was decreased compared with year 2012. In 2012, the Virology Laboratory NIHRD received 3823 ILI samples and in 2013 amounted to 2599 samples. Based on the results of the examination, only 22.4% of positive influenza in 2012 and 23.4% in 2013.
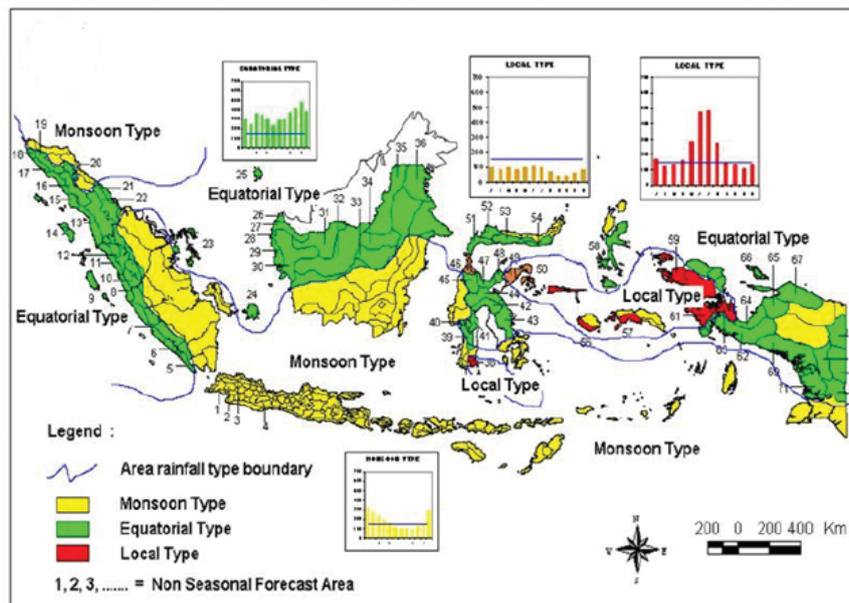

Figure 1. Sentinel of ILI surveillance (Source of the map is taken from Aldrian et. al)
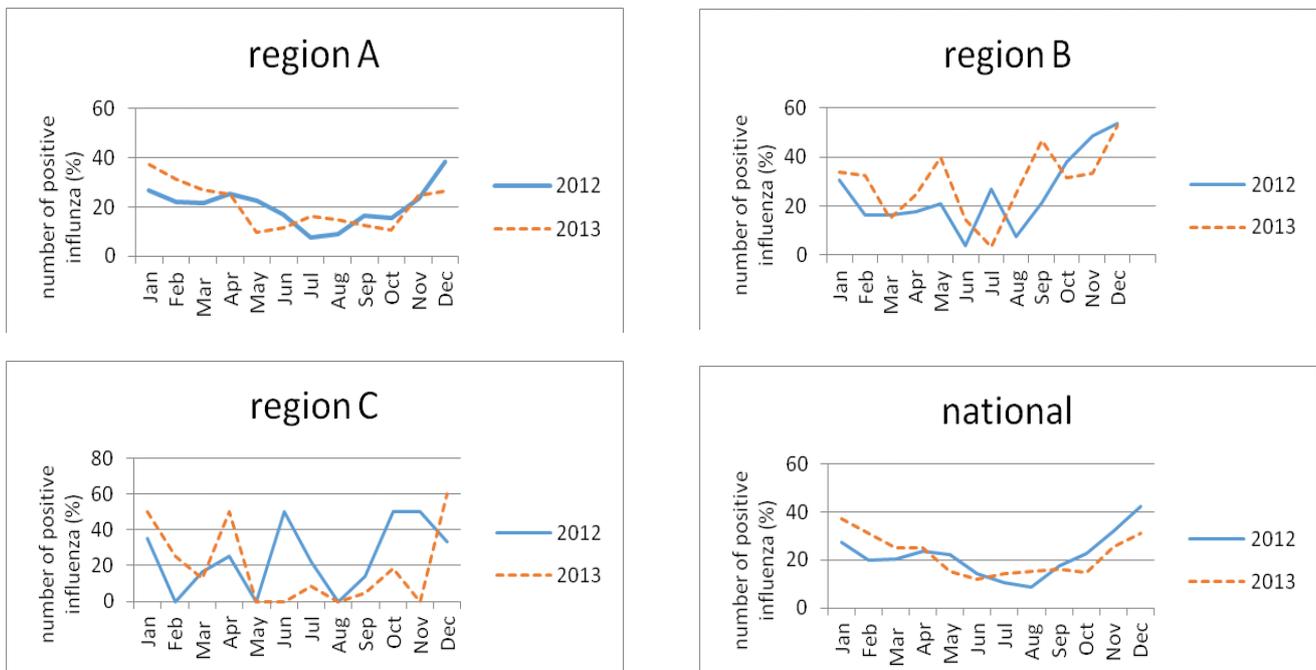

Figure 2. Distribution of positive cases of influenza in Indonesia, 2012-2013

The distribution pattern of influenza in each region varied following the rainfall pattern in the region (Figure 2). At the regional A, peak positive cases of influenza occurred in January. While in the region B, the peak of the positive cases of influenza occurred in April and November. At the regional C, ILI cases did not experience significant fluctuations as region A and B. The peak of the positive cases of influenza in region C occurred in January, as similar as region A.

DISCUSSION

This study has its limitations. ILI surveillance data was collected at 26 sentinel in 2013, without Tangerang, Jakarta, Pontianak and Manado sentinel. In addition, the distribution of ILI sentinels based on region was uneven, which mostly ILI sentinels was grouped in region A while in Region C is only represented by a single sentinel (Maluku).

The number of ILI cases in 2013 was decreased compared to the number of cases in 2012. This is partly due to the reduction in the number of sentinel ILI as many as four sites in 2013. In addition, the change in the definition of ILI used in 2013 was also influential on the reduction of the number of ILI specimens.

Based on the results of the laboratory examination, an increasing number of ILI cases was not linear with the increase of Influenza positive cases. This is probably because the etiology of ILI is not only the influenza virus. Several studies showed that ILI can be caused by other viruses and bacteria, such as Adenovirus, Rhinovirus, Parainfluenza virus, Respiratory Syncytial virus, *Staphilococcus aureus*, *Streptococcus pneumoniae* and *Streptococcus phyogenes*.[18,19,20,21] The most common bacteria found by multiplex PCR method on ILI case specimens in 2012 in Indonesia are *Streptococcus pneumoniae*, *Legionella pneumophila* and *Haemophilus influenza*.[22] The Luminex® test on SARI (Severe Acute Respiratory Infection) case specimens in 2008 showed that Respiratory Syncytial Virus, Coxsakie Virus, Enterovirus and Rhinovirus were the other etiology of respiratory tract infections in children under the age of five.[23]

Climate change and influenza

Monsoon is a strong factor in climate change in Indonesia. Climate change due to monsoon is indicated by the division of Indonesia into three region in accordance with the pattern of the average annual rainfall, the rainfall pattern, monsoon, local and equator.

The rainfall patterns changes in Indonesia resulted in changes in the distribution of influenza. The reduction of the ILI sentinels in 2013 did not significantly affect the distribution pattern of influenza in each region. The distribution pattern of influenza in 2012-2013 was similar to the results of previous study on influenza surveillance in Indonesia by Beckett et al in 1999-2003 and Kosasih et al in 2003-2007 which showed that Influenza in Indonesia occurred throughout the year with peaks around the December in January.[11,24] The pattern of influenza cases is similiar with the regional monsoon type A characterized by a peak over a period of one year. However, when compared by the regional distribution of influenza, the peak of influenza cases in B region occurred with separate peaks, in May and in December. The peak of influenza cases in the region C occurs around April-June. There is a shift in the peak of influenza incidence compared with Becket et al and Kosasih et al. The peak of influenza cases in the region A and C occurred in January, while in the region B occurs in November.

By knowing the distribution pattern of influenza in Indonesia, it is expected that influenza vaccine can be adjusted to the peak of influenza in the region. Saha et al mentioned that the countries that are located close to the equator with a circulation of influenza viruses that take place throughout the year and with no distinct peak influenza activity, the timing for vaccination can be adapted to the dynamics of influenza virus in the respective countries. In addition, the possibility of using a vaccine that is administered once a year could be considered.[25]

In conclusion, the distribution pattern of influenza in 2012 - 2013 in Indonesia following the pattern of the rainy season. Influenza distribution pattern in each province has several variations, based on the peak of the rainy season in each region.

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