

# How people are measuring global and national burden of antimicrobial resistance.

## Do we need a better model?

*Assoc. Prof. Direk Limmathurotsakul, MD MSc PhD*



# Why do we need to accurately measure 'burden of AMR' ?

1) Decide on resource allocation for intervention against AMR at local, national, regional and global levels

*Does AMR or cancer cause more deaths in my country?*

2) Inform the implementation of action plans (at all levels)

*Are there less people die of AMR this year?*

# How many die of AMR globally?

**700,000 deaths** (AMR Review 2014)

Only MDR and XDR TB (126,000 deaths) is measured in The Global Burden Disease (GBD) (Lancet 2017)

**However, not measured in each national statistics**

For example, in 2016, the 10 leading COD in the US (CDC) were heart disease, cancer, unintentional injuries, chronic lower respiratory diseases, stroke, Alzheimer's disease, diabetes, influenza and pneumonia, kidney disease, and suicide

# What is cause of death?

To Be Completed By: MEDICAL CERTIFIER	29. ACTUAL OR PRESUMED DATE OF DEATH (MO/Day/Yr)	30. ACTUAL OR PRESUMED TIME OF DEATH	31. WAS MEDICAL EXAMINER OR CORONER CONTACTED? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
	<b>CAUSE OF DEATH</b>			Approximate interval: Onset to death
	<p>32. Part I. Enter the chain of events--diseases, injuries, or complications--that directly caused the death. DO NOT enter terminal events such as cardiac arrest, respiratory arrest, or ventricular fibrillation without showing the etiology. DO NOT ABBREVIATE. Enter only one cause on a line. Add additional lines if necessary.</p> <p>IMMEDIATE CAUSE (final disease or condition resulting in death) → a. <b>sepsis</b> Due to (or as a consequence of): _____</p> <p>Sequentially list conditions, if any, leading to the cause listed on line a. Enter the UNDERLYING CAUSE (disease or injury that initiated the events results in death) LAST</p> <p>b. <b>Acinetobacter bacteraemia</b> Due to (or as a consequence of): _____</p> <p>c. <b>Hospital-acquired pneumonia</b> Due to (or as a consequence of): _____</p> <p>d. <b>Ischaemic heart disease</b> ←</p> <p>Due to (or as a consequence of): _____</p>			<p>Part II. Enter other significant conditions contributing to death but not resulting in the underlying cause given in PART I</p> <p style="text-align: center;"><b>Chronic kidney disease</b></p>

Cause of death in national statistics according to ICD-10 principle

To Be Completed By: MEDICAL CERTIFIER	29. ACTUAL OR PRESUMED DATE OF DEATH (MO/Day/Yr)	30. ACTUAL OR PRESUMED TIME OF DEATH	31. WAS MEDICAL EXAMINER OR CORONER CONTACTED? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
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Cause of death in national statistics according to ICD-10 principle

# Why is AMR not in the main GBD COD paper?

“One person can die of only from one cause of death (COD)”

“ICD codes that cannot be underlying causes of death (eg, senility or low back pain); ICD codes that are considered **intermediate causes of death** (eg, sepsis and heart failure); and ICD codes that lack specificity in coding (eg, unspecified cancer or unspecified cardiovascular disease) were **redistributed**.”

# Current approaches being used

**1) ICD principle (GBD main COD)**

**2) All-cause mortality**

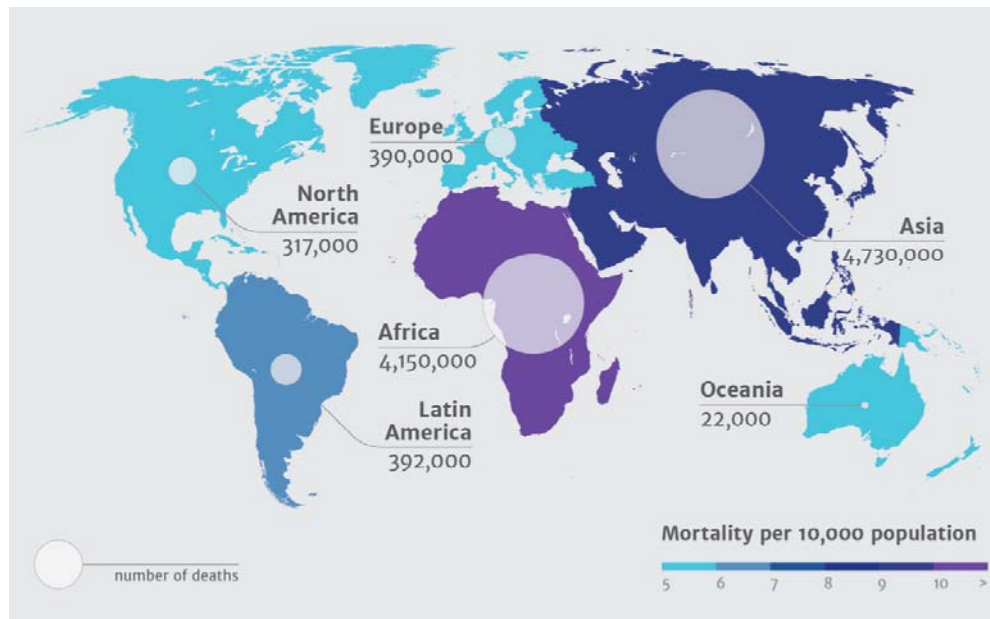
e.g. in-hospital mortality, 30-day mortality, 90-day mortality  
i.e. “deaths involving XXX”

**3) Attributable mortality**

counterfactual approach; how many deaths would not have occurred in the absence of the disease or condition of interest.  
require model and population data

# Example of mortality attributable to AMR

700,000 deaths/year



$$\begin{array}{|c|} \hline \text{Incidence of} \\ \text{infections} \\ \text{(episodes)} \\ \hline \end{array} \times \begin{array}{|c|} \hline \text{Prevalence of} \\ \text{antimicrobial-} \\ \text{resistance (\%)} \\ \hline \end{array} \times \begin{array}{|c|} \hline \text{Attributable} \\ \text{mortality rate for} \\ \text{AMR (\%)} \\ \hline \end{array} = \begin{array}{|c|} \hline \text{Mortality} \\ \text{attributable to} \\ \text{AMR (deaths)} \\ \hline \end{array}$$

# Example of mortality attributable to AMR

**700,000 deaths/year**

## Assumptions used:

Attributable mortality for AMR in the US and the Europe was based on reports of **US CDC** and **ECDC/EMEA**.

Attributable mortality for AMR per 100,000 population in all other countries is assumed to be **equal to that observed in the US**, except for tuberculosis, where global resistance estimates (WHO data) were used.

→ Highlighting the problem of no data !!!!

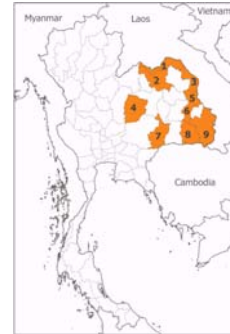


**How many die of AMR in Thailand ?**

# 19,000 died of AMR in Thailand

## Epidemiology and burden of multidrug-resistant bacterial infection in a developing country

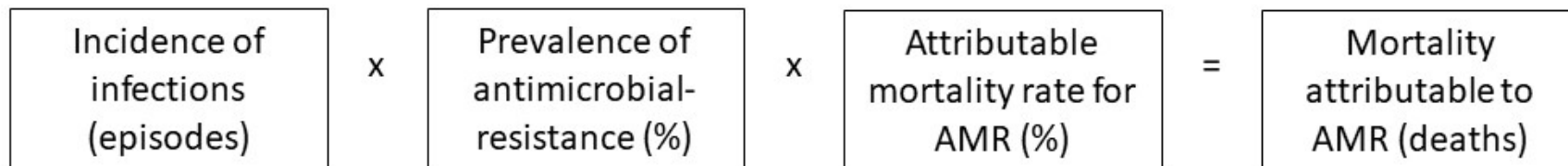
Cherry Lim<sup>1†</sup>, Emi Takahashi<sup>1†</sup>, Maliwan Hongsuwan<sup>1</sup>, Vanaporn Wuthiekanun<sup>1</sup>, Visanu Thamlikitkul<sup>2</sup>, Soawapak Hinjoy<sup>3</sup>, Nicholas PJ Day<sup>1,4</sup>, Sharon J Peacock<sup>1,5,6</sup>, Direk Limmathurotsakul<sup>1,4,7\*</sup>



**Methods: Microbiology laboratory + hospital databases + death registry (& similar model to AMR review)**

**Using attributable mortality rate and known incidence rate**

**Findings: 19,000 died of AMR in Thailand, and MDR-*Acinetobacter* spp. is the most important pathogen**



# 19,000 died of AMR in Thailand

Methods could be applied to monitor the Goal #1 of NSP

## National Strategic Plan on Antimicrobial Resistance 2017-2021 Thailand

### Goals:

- 1 50% reduction in AMR morbidity
- 2 20% reduction in antimicrobial use in human
- 3 30% reduction in antimicrobial use in animal
- 4 20% increase of public knowledge on AMR and awareness of appropriate use of antimicrobials
- 5 Capacity of the national AMR management system is improved to level 4<sup>2</sup>

# Current approaches being used

Approaches	Advantage	Disadvantage
ICD principle	<ul style="list-style-type: none"><li>- Can cover all diseases evaluated (e.g. 246 COD in GBD 2016)</li><li>- Consistent methods applied to all diseases evaluated</li></ul>	<ul style="list-style-type: none"><li>- Majority of hospital-acquired AMRI and an unknown proportion of community-acquired AMRI may not be counted as causes of death</li></ul>
All-cause mortality	<ul style="list-style-type: none"><li>- Easy to standardize</li></ul>	<ul style="list-style-type: none"><li>- Other causes of death may be included</li></ul>
Attributable mortality	<ul style="list-style-type: none"><li>- Can be specific to AMR</li><li>- Can be used to directly estimate the economic cost of AMR</li></ul>	<ul style="list-style-type: none"><li>- Hard to accurately measure</li><li>- Hard to understand; what does death attributable to AMR mean?</li></ul>

**Which approach will  
the estimation of the global burden of  
AMR use?**

# Potential actions

Issues	Recommendations
Model	<ul style="list-style-type: none"><li>- Develop an improved model to estimate deaths caused by AMR</li><li>- Need to be robust, reliable and acceptable to policy makers, researchers and healthcare providers</li></ul>
Cause of AMR	<ul style="list-style-type: none"><li>- Clearly separate the burden of <b>community-acquired AMR</b> and <b>hospital-acquired AMR</b></li></ul>
Health systems	<ul style="list-style-type: none"><li>- Increase country <b>capability and capacity to reliably diagnose AMR</b>, and link test results to clinical outcome in order to inform the model</li><li>- Increase capacity to <b>utilize the data</b> of microbiological surveillance for therapy decisions, policy change and intervention implementations <b>locally and nationally</b></li></ul>

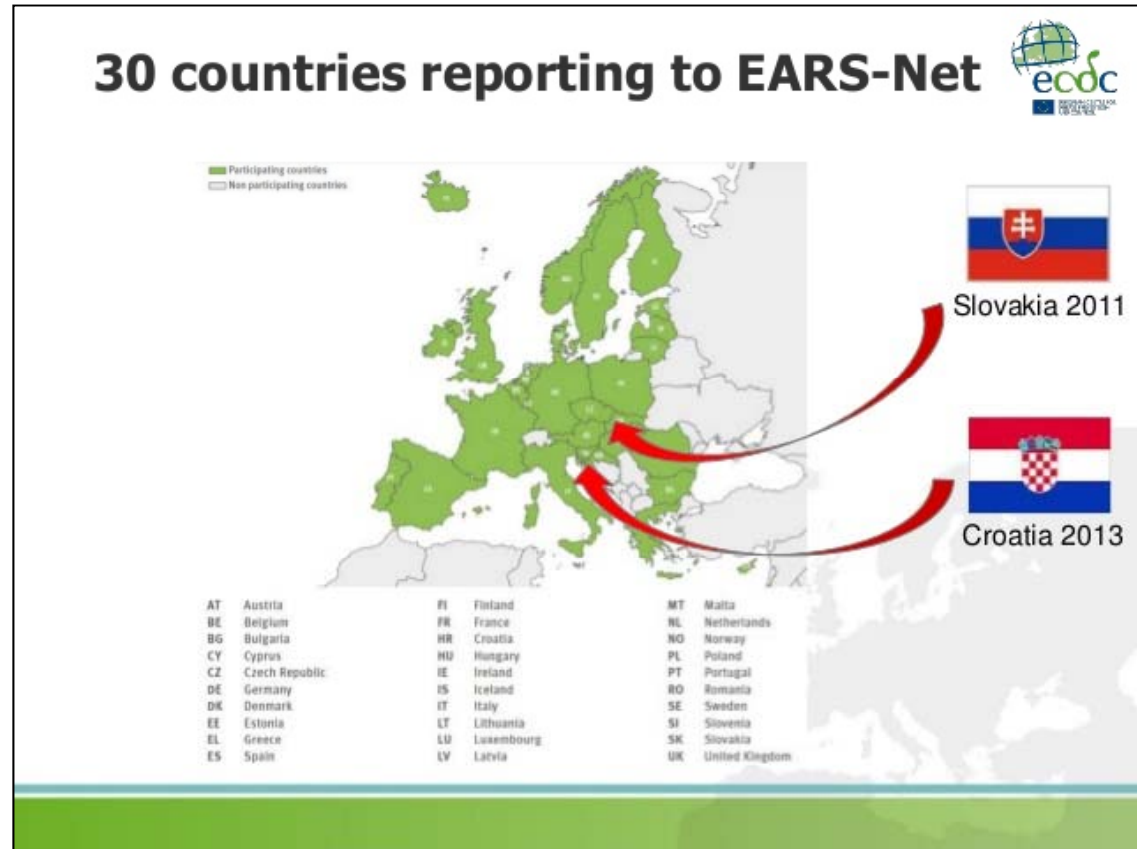
# Potential actions

Issues	Recommendations
Data to be used by the model	<ul style="list-style-type: none"><li>- Improve the quality and availability of ICD coded mortality data from vital registration systems, and of the data required to determine attributable mortality rates</li><li>- Training in correct certification of causes of death using the ICD rules</li><li>- Improve understanding of how infectious diseases, sepsis and AMR are recorded as the main, immediate or intermediate causes of death</li><li>- Design and implement prospective studies to generate parameters to inform AMR burden estimation through routine surveillance</li></ul>

**Further regional consideration**

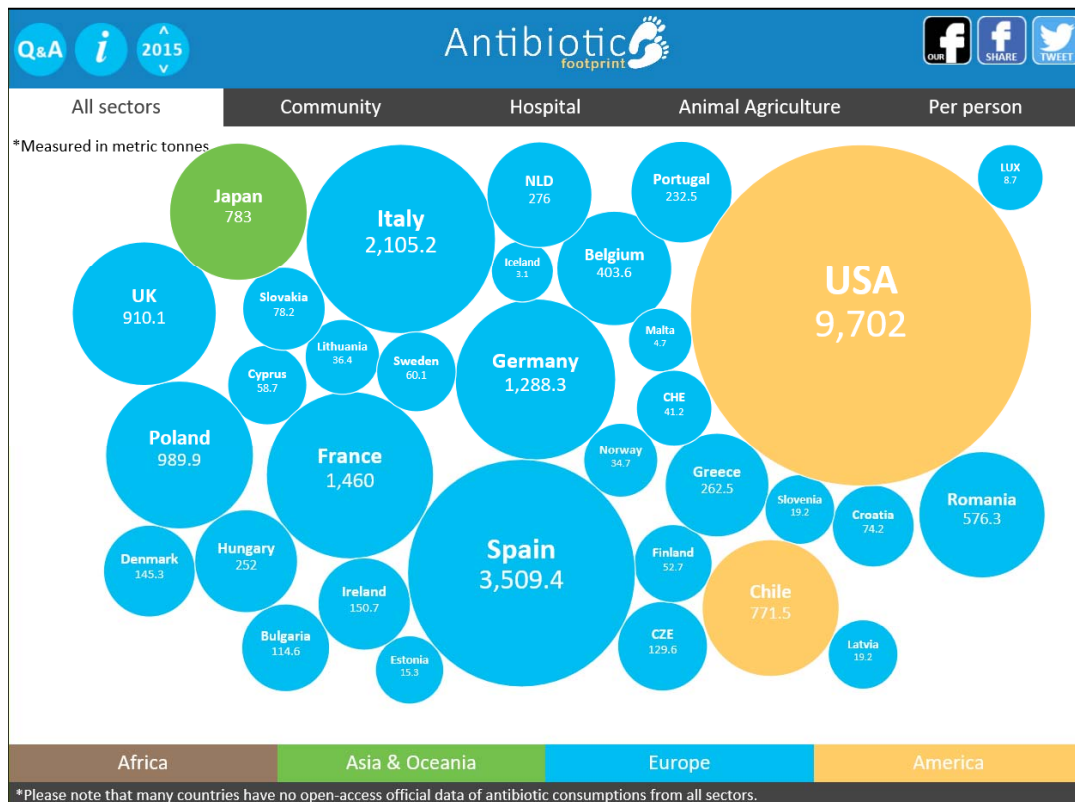


# 1) No formal network in SEA



## 2) No official and open-access data from every country in SEA

*“How many tonnes of antibiotics are consumed in each country in 2015?”*

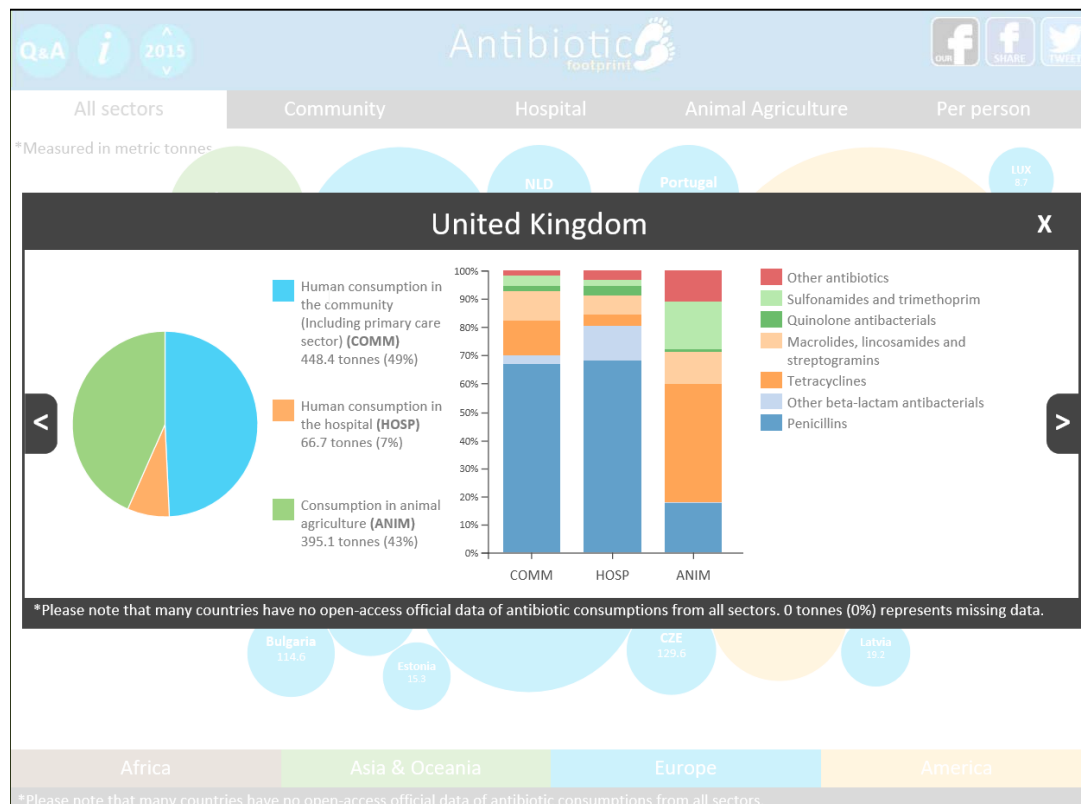


[www.antibioticfootprint.net](http://www.antibioticfootprint.net)



## 2) No official and open-access data from every country in SEA

*“How many tonnes of antibiotics are consumed in each country in 2015?”*



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National Veterinary Assay Laboratory  
Ministry of Agriculture, Forestry & Fisheries

Servicio Agrícola y Ganadero | SAG

# 3) Data sharing and local implication

## Documents



### [Annual epidemiological commentary: Gram-negative, MRSA and MSSA bacteraemia and C. difficile infection data, up to and including financial year April 2017 to March 2018](#)

Ref: PHE publications gateway number: 2018236  
PDF, 3.19MB, 83 pages



Public Health  
England

## Attributable deaths and disability-adjusted life-years caused by infections with antibiotic-resistant bacteria in the EU and the European Economic Area in 2015: a population-level modelling analysis

*Alessandro Cassini, Liselotte Diaz Högberg, Diamantis Plachouras, Annalisa Quattrocchi, Ana Hoxha, Gunnar Skov Simonsen, Mélanie Colomb-Cotinat, Mirjam E Kretzschmar, Brecht Devleeschauwer, Michele Cecchini, Driss Ait Ouakrim, Tiago Cravo Oliveira, Marc J Struelens, Carl Suetens, Dominique L Monnet, and the Burden of AMR Collaborative Group\**

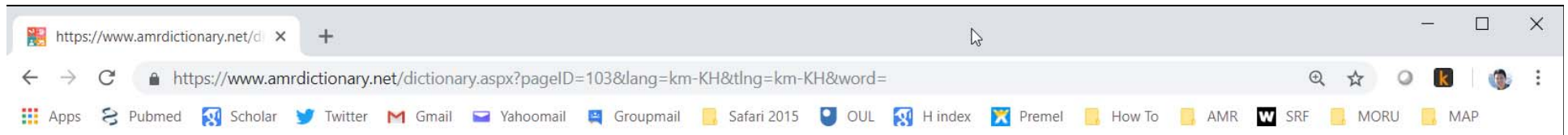


**When will we have Asia-CDC ?**

**When will each country openly and formally publish their data and report ?**

**Together, we can make it happen faster!!**

# www.amrdictionary.net



វចនានុក្រមស្តីពីភាពសុំនឹងឱសថប្រឆាំងរោគគ



English | ភាសាខ្មែរ | ພາສາລາວ | ភាសាស៊ី | ភាសាไทย | Tiếng Việt



**Word of the month**  
Antibiotic resistance



**New word**  
Superbug



**ទាញយក**  
ទាញយកវចនានុក្រម  
ក្រុមហ៊ុន AMR  
ទាំងមូល នៅទីនេះ

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# www.amrdictionary.net

The screenshot shows a web browser window with the URL [https://www.amrdictionary.net/dictionary.aspx?word=ភាពស៊ាំនឹងឱសថអង់ទីប៊ីយោទិក%20\(ភាពស៊ាំនឹងថ្នាំផ្សះ\)&tlng=km-KH&lang=km-KH](https://www.amrdictionary.net/dictionary.aspx?word=ភាពស៊ាំនឹងឱសថអង់ទីប៊ីយោទិក%20(ភាពស៊ាំនឹងថ្នាំផ្សះ)&tlng=km-KH&lang=km-KH). The page features a navigation bar with various icons and a sidebar on the left with three items: 'Word of the month' (Antibiotic resistance), 'New word' (Superbug), and a green checkmark icon with Khmer text 'ទាញយក ទាញយកវចនានុក្រមក្រុមហ៊ុន AMR ទាំងមូល នៅទីនេះ:'. The main content area has a blue header with the Khmer title 'ភាពស៊ាំនឹងឱសថអង់ទីប៊ីយោទិក (ភាពស៊ាំនឹងថ្នាំផ្សះ)'. Below the header, there is a 'Translated' section with three entries: 'Antibiotic resistance' (UK flag), 'การดื้อยาปฏิชีวนะ' (TH flag), 'ပဋိဇီဝ ပိုးသတ်ဆေး' (MY flag), and 'Kháng kháng sinh' (VN flag). The main text block contains Khmer text: '(នាម) លទ្ធភាពរបស់បាក់តេរីក្នុងការបញ្ឈប់ពីការសម្លាប់ ឬសកម្មភាពប្រឆាំងរបស់ឱសថអង់ទីប៊ីយោទិកមួយប្រភេទ (ឬច្រើនប្រភេទ) មកលើវា។' followed by two quoted Khmer paragraphs. The first quote is: '«ការប្រើប្រាស់ឱសថអង់ទីប៊ីយោទិកលើសកម្រិត និងមិនត្រឹមត្រូវ អាចធ្វើឱ្យមានភាពស៊ាំនឹងឱសថអង់ទីប៊ីយោទិក។»' and the second is: '«ទោះបីជាការប្រើប្រាស់ត្រឹមត្រូវនិងតាមវេជ្ជបញ្ជាក៏ដោយ ក៏ឱសថអង់ទីប៊ីយោទិកនៅតែអាចធ្វើឱ្យបាក់តេរីវត្តទៅរកភាពស៊ាំនឹងឱសថអង់ទីប៊ីយោទិកបានដែរ។ ប៉ុន្តែ ភាពស៊ាំនឹងឱសថអង់ទីប៊ីយោទិកមានការកើនឡើងជាលំដាប់ នេះក៏ព្រោះតែការប្រើប្រាស់ឱសថអង់ទីប៊ីយោទិកនៅពេលពុំចាំបាច់និងលើសកម្រិត។» [១]'



# www.amrdictionary.net

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ចំពោះសាធារណជនទូទៅ

## វចនានុក្រមស្តីពីភាពស៊ាំនឹងឱសថប្រឆាំងរោគគ

AMR dictionary

**COMRU.**

**GREENPEACE**

### បុព្វកថា

វចនានុក្រម ភាពស៊ាំនឹងឱសថប្រឆាំងរោគ (The AMR dictionary) (មានឯកសារជា PDF និងលើគេហទំព័រ [www.amrdictionary.net](http://www.amrdictionary.net)) មានគោលបំណងផ្តល់ការអប់រំ និងព័ត៌មានកែប្រែឃ្លោះ។ អ្នកអានអាចទទួលបាននូវចំណេះដឹងថ្មី និងមាននៅក្នុងមាតិកាបណ្ណាល័យវចនានុក្រមនេះ រួមមានទាំងចំណុចគ្រឹះស្ថាន និងបែបបទស្រាវជ្រាវ កែប្រែនៃសម្រាប់ជំនួសដំបូងរបស់អ្នកមានជំនាញខាងវេជ្ជសាស្ត្រ ការធ្វើរោគវិនិច្ឆ័យ ឬការព្យាបាលនោះទេ។

ប្រសិនបើអ្នកមិនសូវស្គាល់អ្វីទៅច្បាស់ នឹងទទួលបានដំបូងបង្អស់ ឬប្រតិបត្តិការសុខាភិបាលដែលនៅជិត ប្រមូលទាំងស្រុងនៅក្នុងភាពស៊ាំនឹងឱសថប្រឆាំងរោគរបស់អ្នក។ អ្នកមិនត្រូវច្របូកច្របល់ប្រហែលក្នុងការស្រាវជ្រាវដំបូងរបស់អ្នកទេ ឬក៏ពន្យារពេលស្រាវជ្រាវសុខាភិបាលរបស់អ្នកនោះទេ។

ចំពោះដឹង ការស្រាវជ្រាវ និងការអនុវត្តនៅក្នុងវិស័យនេះកំពុងតែមានការផ្លាស់ប្តូរយ៉ាងឆាប់រហ័ស។ វចនានុក្រម ភាពស៊ាំនឹងឱសថប្រឆាំងរោគ នឹងធ្វើបច្ចុប្បន្នភាពទៅលើមាតិកាជាញឹកញយ ទាំងនៅក្នុងឯកសារPDF និងគេហទំព័រ។ សូមអានទាំងអស់ ត្រូវទុកចិត្តចំពោះអនុសាសន៍របស់បុគ្គលិកសុខាភិបាលនៅក្នុងប្រទេស និងឯកសារផ្លូវការស្តីពីភាពស៊ាំនឹងឱសថប្រឆាំងរោគដែលចេញដោយរដ្ឋាភិបាល អំពីការយកម្ល៉ែងកំណត់ ហើយក៏ត្រូវយកចិត្តទុកដាក់លើស្តីពីភាពស៊ាំនឹងឱសថប្រឆាំងរោគរបស់អ្នក និងមនុស្សច្រើនទៀតផងដែរ។

វចនានុក្រមនេះមិនបានទទួលការបញ្ជាក់ពីស្ថាប័នឯកជន ឬក្រុមហ៊ុនឱសថណានោះទេ ហើយក៏មិនមានការផ្សព្វផ្សាយពាណិជ្ជកម្មអ្វីនោះដែរ។ វចនានុក្រម **ភាពស៊ាំនឹងឱសថប្រឆាំងរោគ** នឹងត្រូវបានផ្សព្វផ្សាយជាសារពាណិជ្ជកម្មនៅក្រោមអាជ្ញាប័ណ្ណ (CC BY license (Creative Common Attribution 4.0))

ដោយសេចក្តីគោរពរាប់អាន

ក្រុមការងារបកប្រែវចនានុក្រម **ភាពស៊ាំនឹងឱសថប្រឆាំងរោគ**

យើងមានបណ្តាញទំនាក់ទំនងច្រើនភាសា

១) ប្រសិនបើលោកអ្នកមានសំណួរអំពីភាពស៊ាំនឹងឱសថប្រឆាំងរោគ សូមចូលទស្សនាគេហទំព័ររបស់យើងដោយលេខ [www.amrdictionary.net](http://www.amrdictionary.net) ឬទំព័រហ្វេសប៊ុក [fb.me/amrdictionary](https://www.facebook.com/amrdictionary)

២) ប្រសិនបើលោកអ្នកចង់ផ្តល់មតិវិចារណៈ ស្តាប់នូវយោបល់ សូមចូលតាមរយៈ QR code (<https://www.surveymonkey.com/r/amrdictionary>)

៣) ប្រសិនបើលោកអ្នកមានយោបល់ ឬសំណួរអំពីវចនានុក្រមនេះ ឬមាតិកាបណ្ណាល័យវចនានុក្រម លោកអ្នកអាចផ្ញើសារអធិប្បាយដោយផ្ទាល់មាត់ [lavikanya@tropmedres.ac](mailto:lavikanya@tropmedres.ac) និង [direk@tropmedres.ac](mailto:direk@tropmedres.ac) ។



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