

# Infectious disease modelling

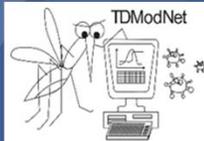
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Department of Tropical Hygiene

Mahidol University

GCRF and UK Mathematical Sciences, Edinburg 2018



# Outline

2 research projects

- NTD/NZD modelling : Leptospirosis
- Population dynamic and impact on some infectious diseases



# Zoonotic disease modelling

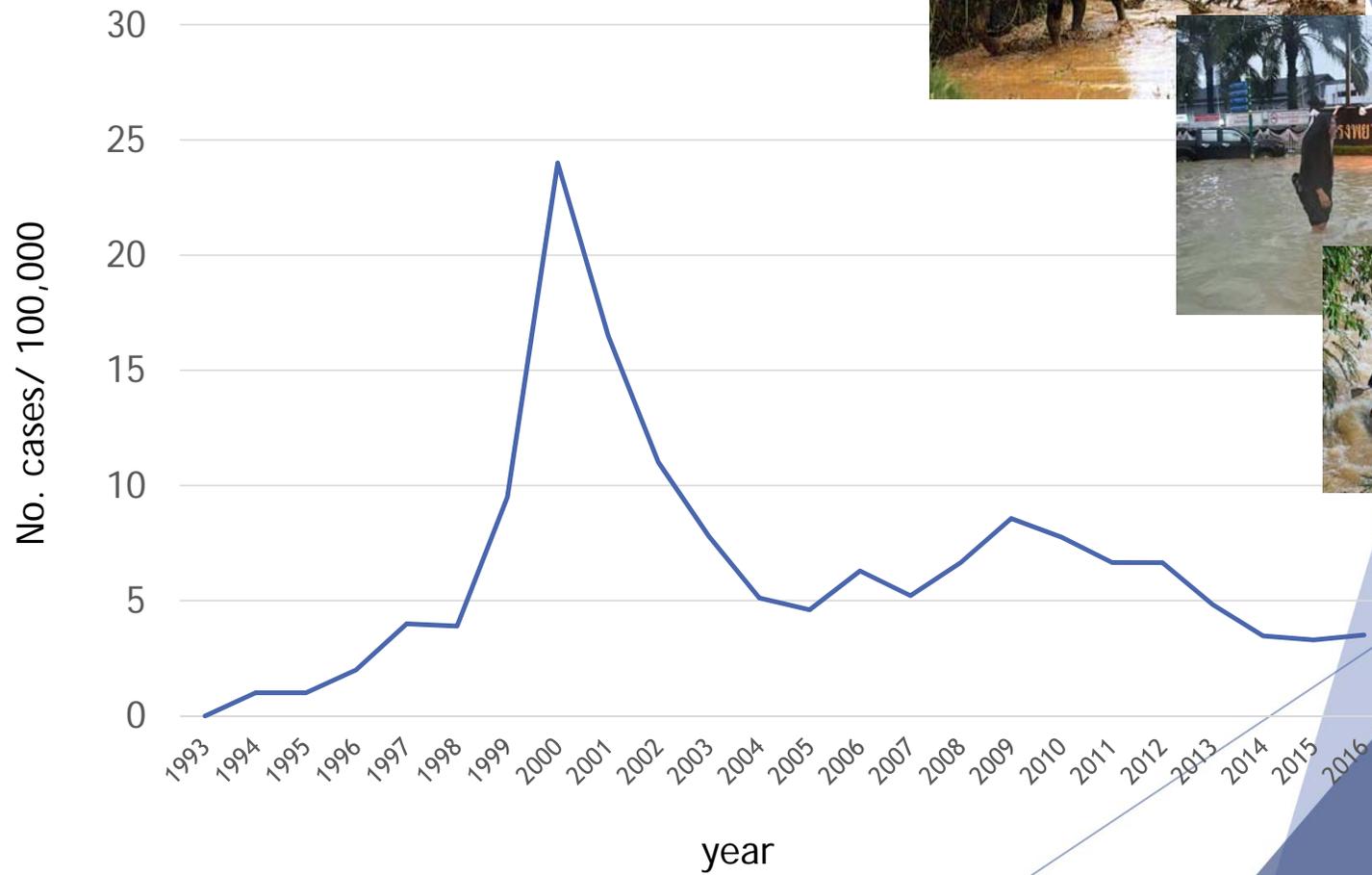


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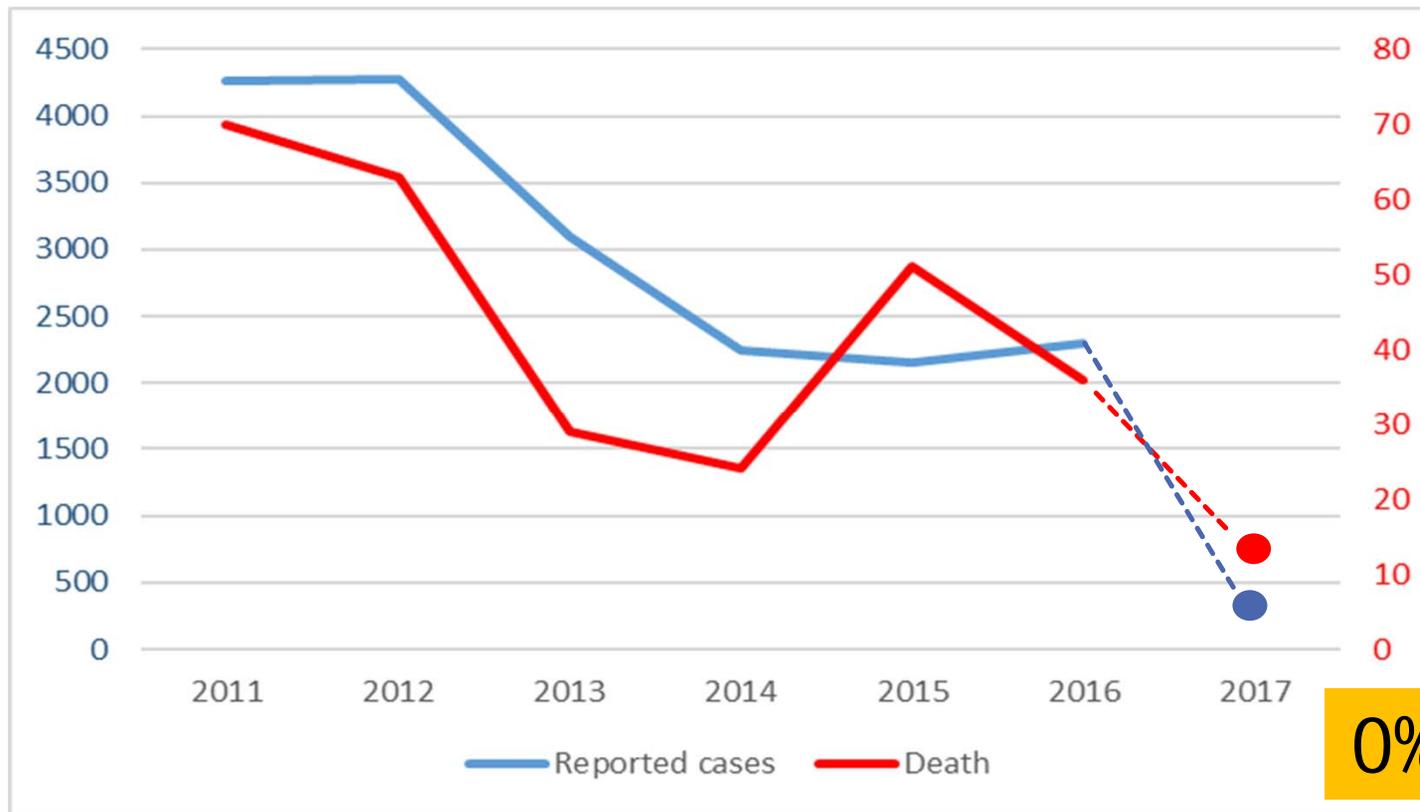
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# Leptospirosis, Thailand



# Public health prospective



0% DEATH?

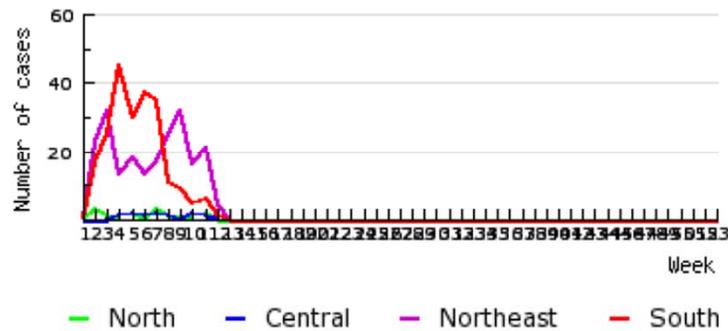
**Southern**



**Northeastern**



Number of Leptospirosis cases by week of onset and region.  
2560

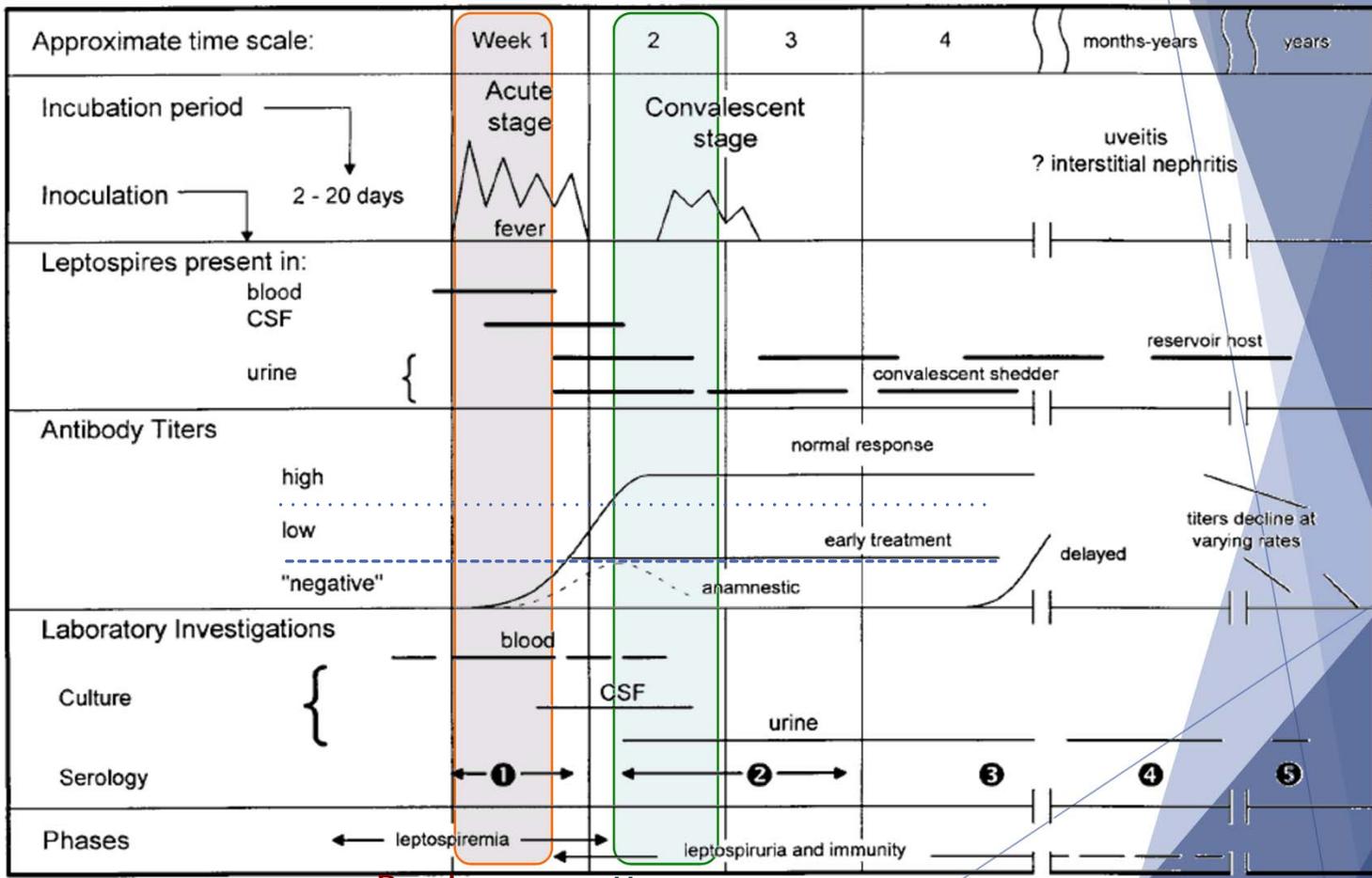


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# Challenges

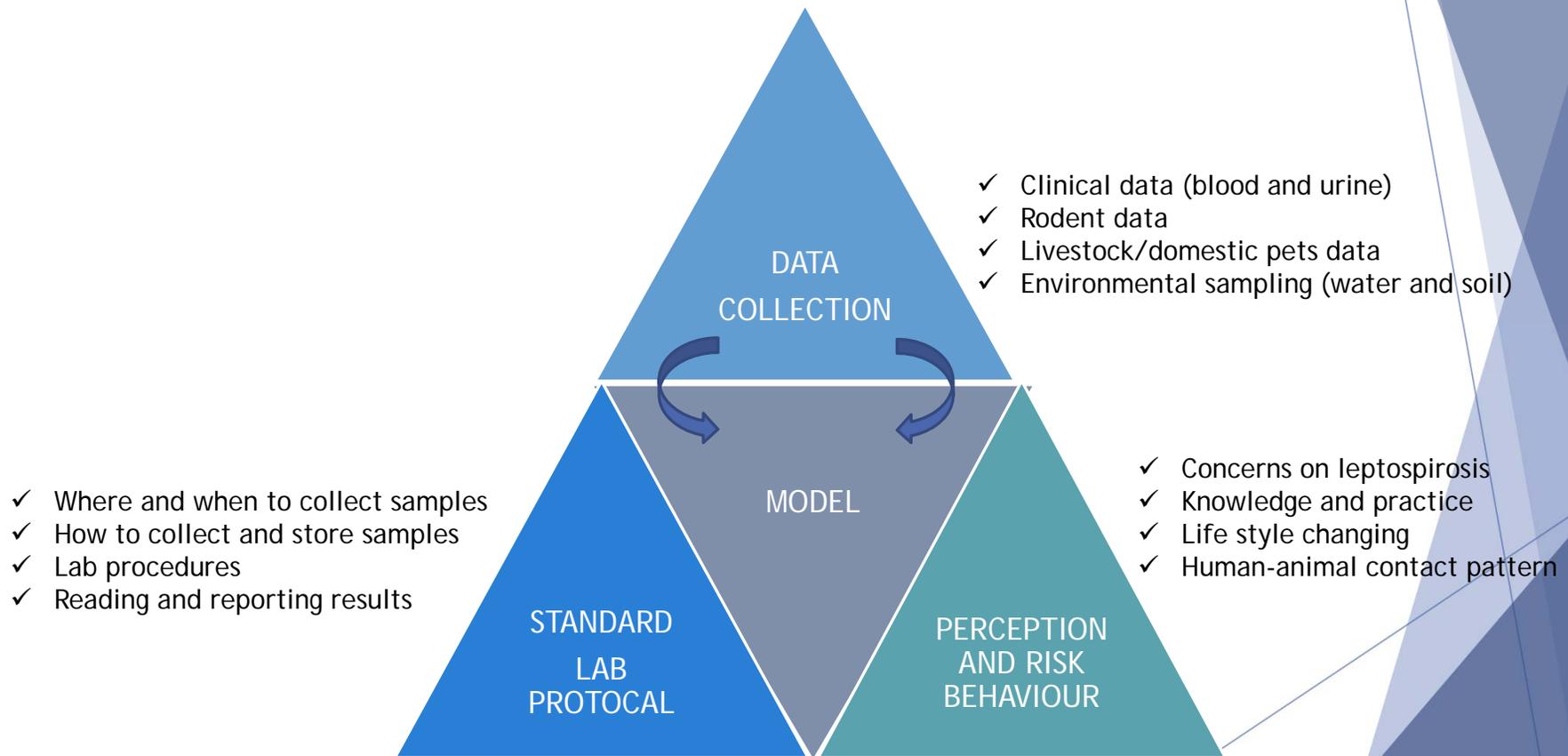
- ▶ Hard to early detect the infections due to various but non-specific symptoms. Although doxycycline has been recommended as an empirical treatment, many still progress to deaths.
- ▶ The disease mostly prevalent in poor population with little knowledge on leptospirosis. Under-detection and under-report of cases. Prevention and control strategies are not consistent.
- ▶ Diagnostic tests are not well performed, unavailable and too specific to timing of infections. Most settings rely on clinical diagnosis.
- ▶ Laboratory investigations are not simple and time consuming, causing delay in research progress.

PCR or culture MAT or IgM ELISA

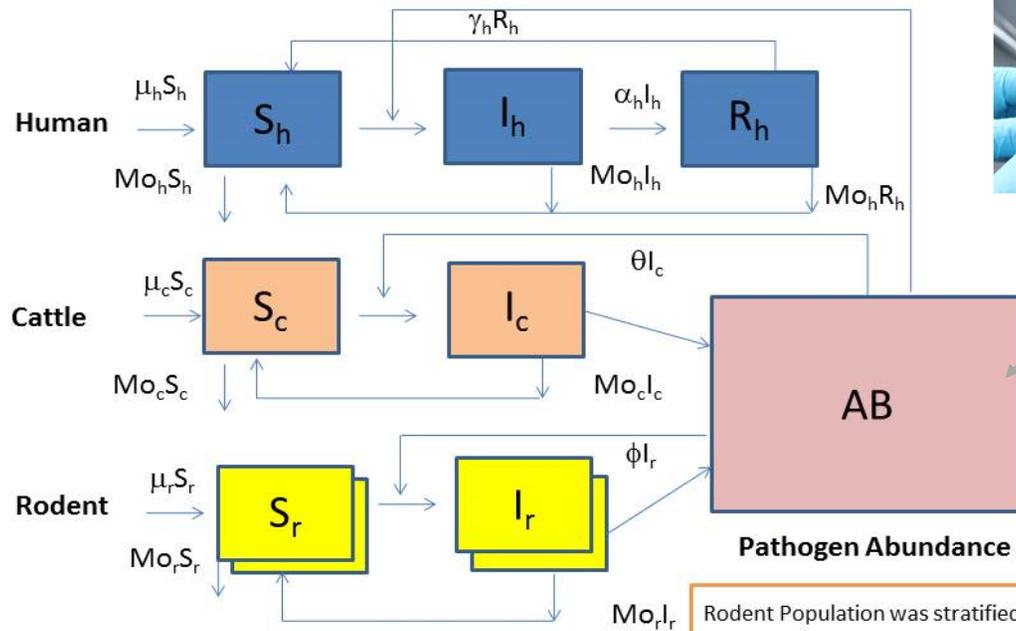


Rarely use Use more

# Multidisciplinary Approach



# Model structure

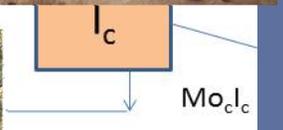
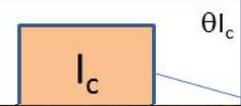


Rodent Population was stratified by habitats;  
 1. Reservoirs in village  
 2. Reservoirs in rice field



?

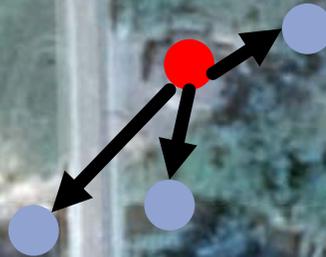
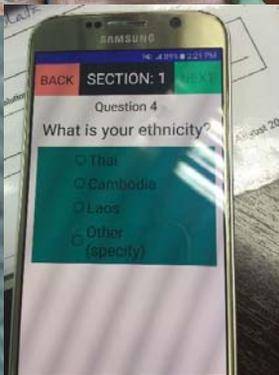
domestic pets



# Human-Animal contact survey



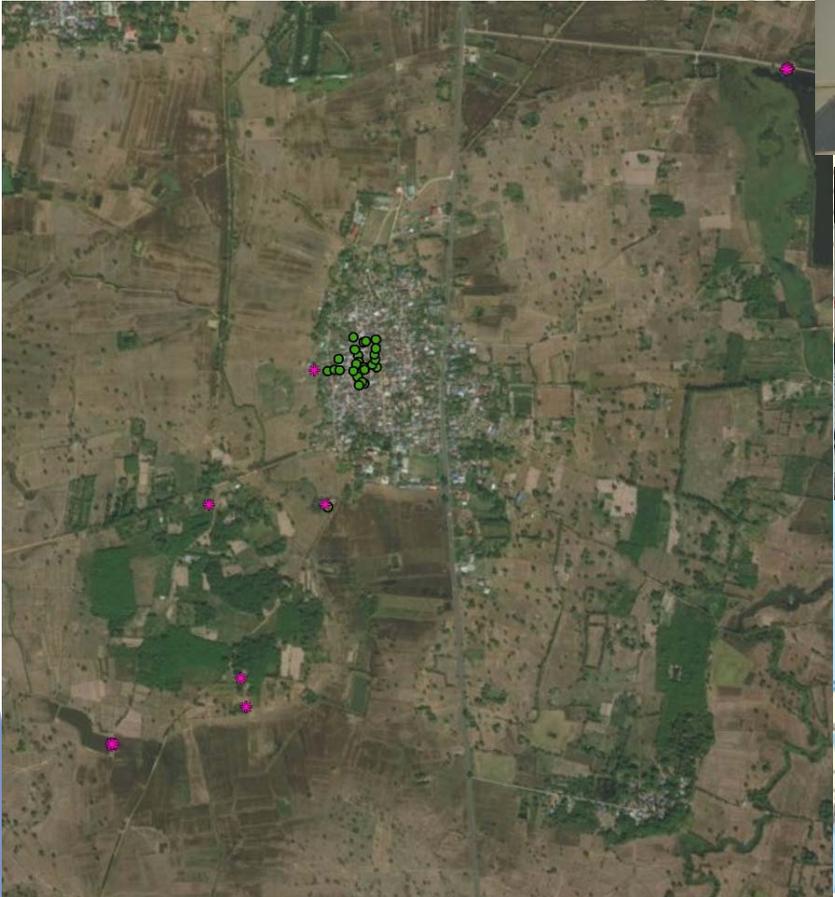
Small pig farm (30)  
Chicken (20)  
Ducks (6)  
Dogs (15)  
Cat (1)



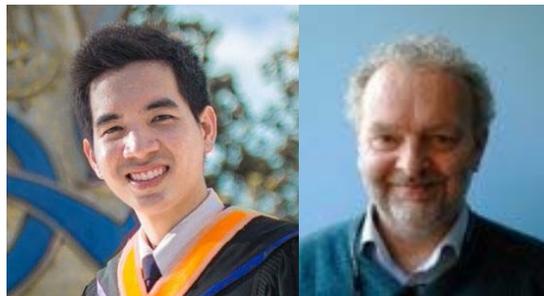
3D



# Sisaket



# Population dynamic and infectious diseases

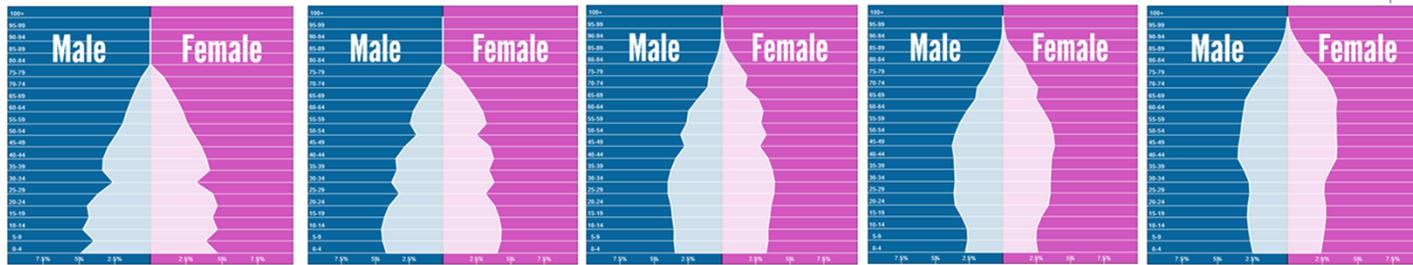


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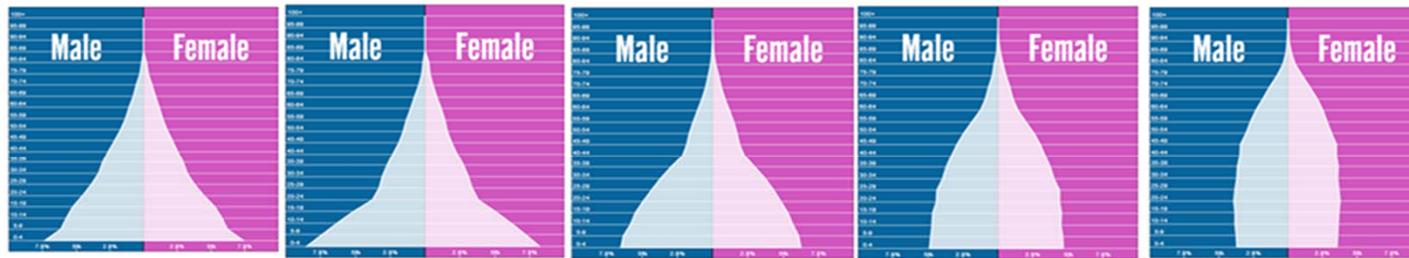
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## Europe



## Southeast Asia



1950

1970

1990

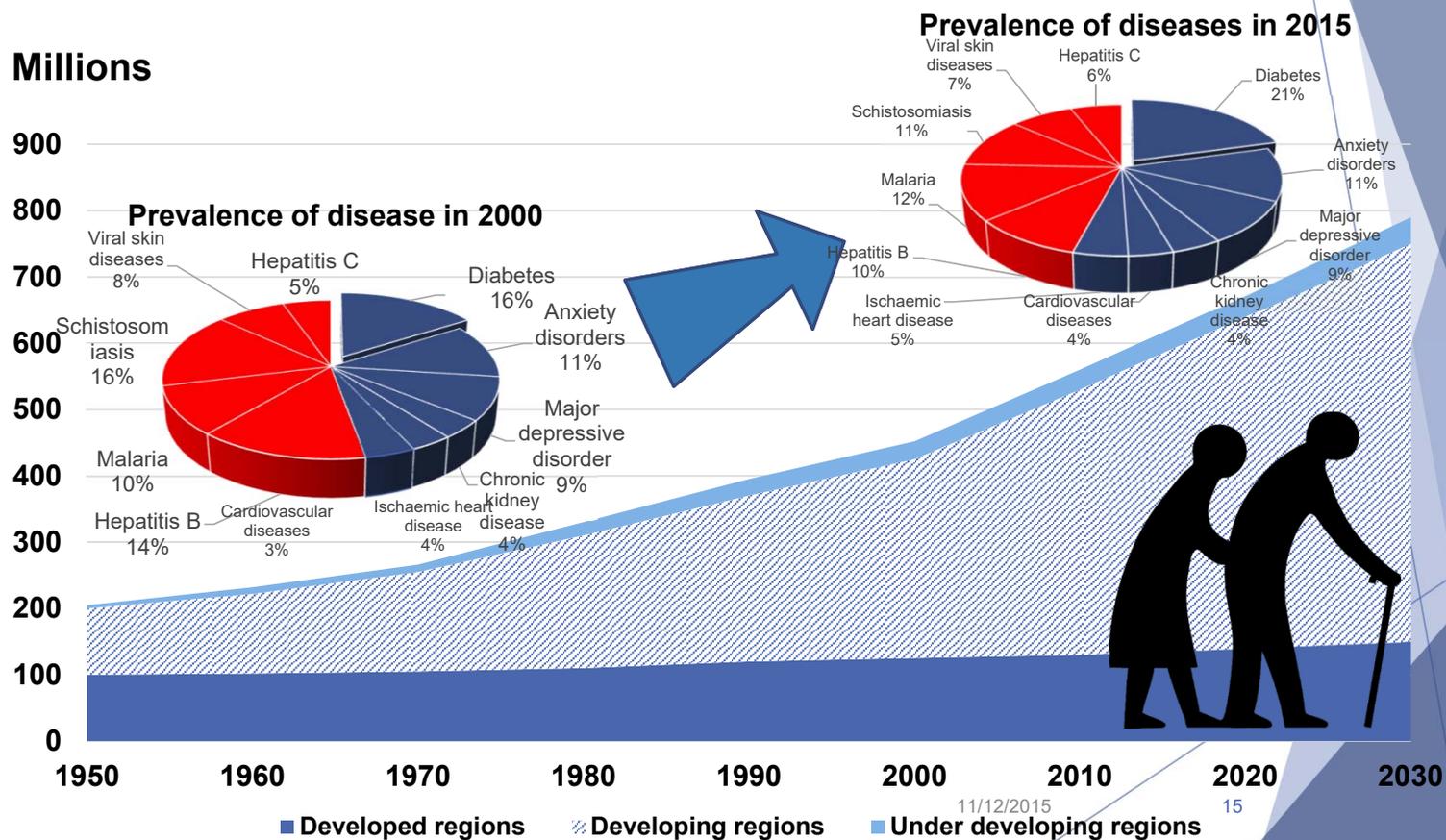
2010

2030

From <http://populationpyramid.net>

# Ageing Population & Disease

Population aged 60 or over: world and development regions, 1950-2030

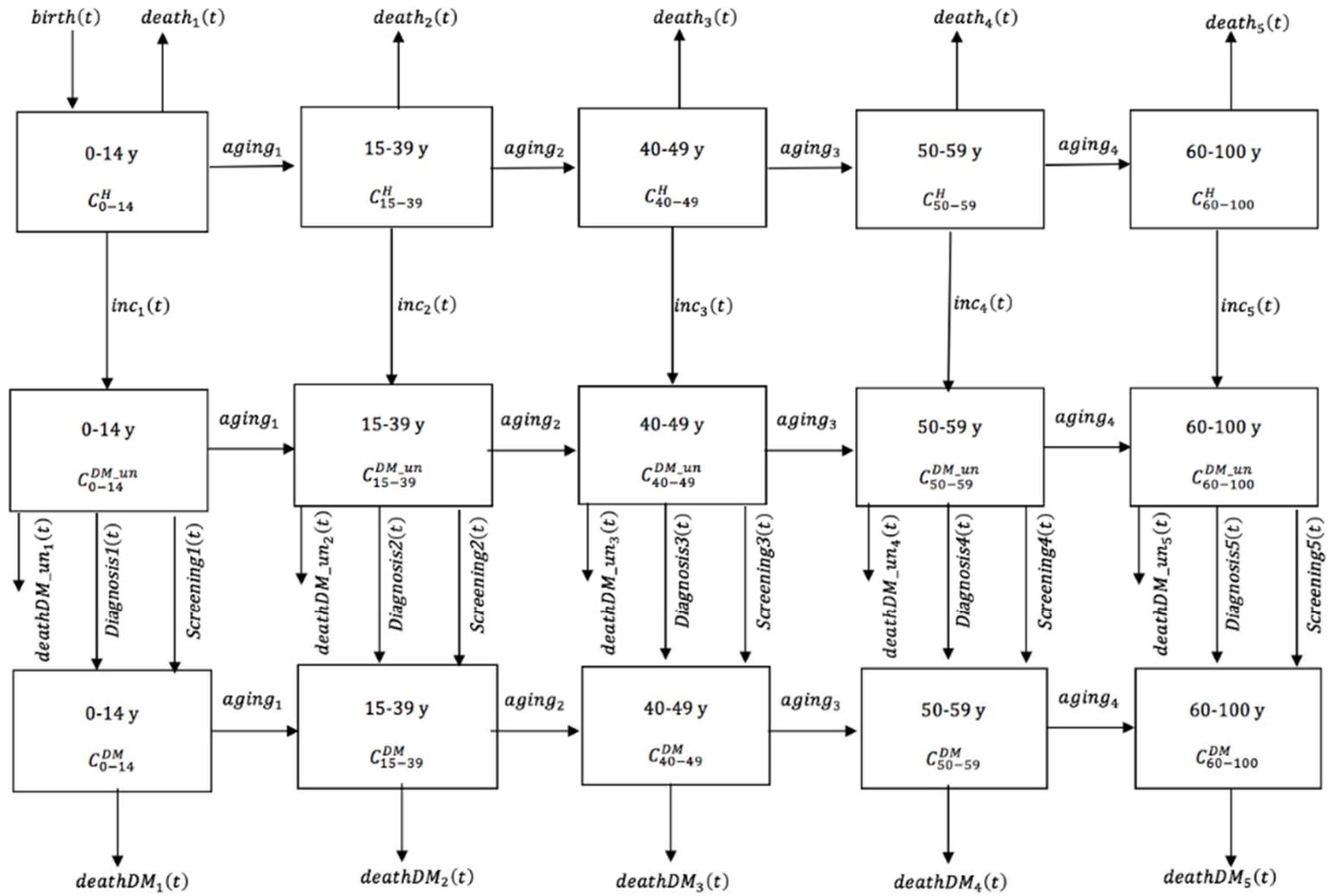


Data source: GBD 2015 Disease and Injury Incidence and Prevalence Collaborators, 2016 (Lancet)

11/12/2015

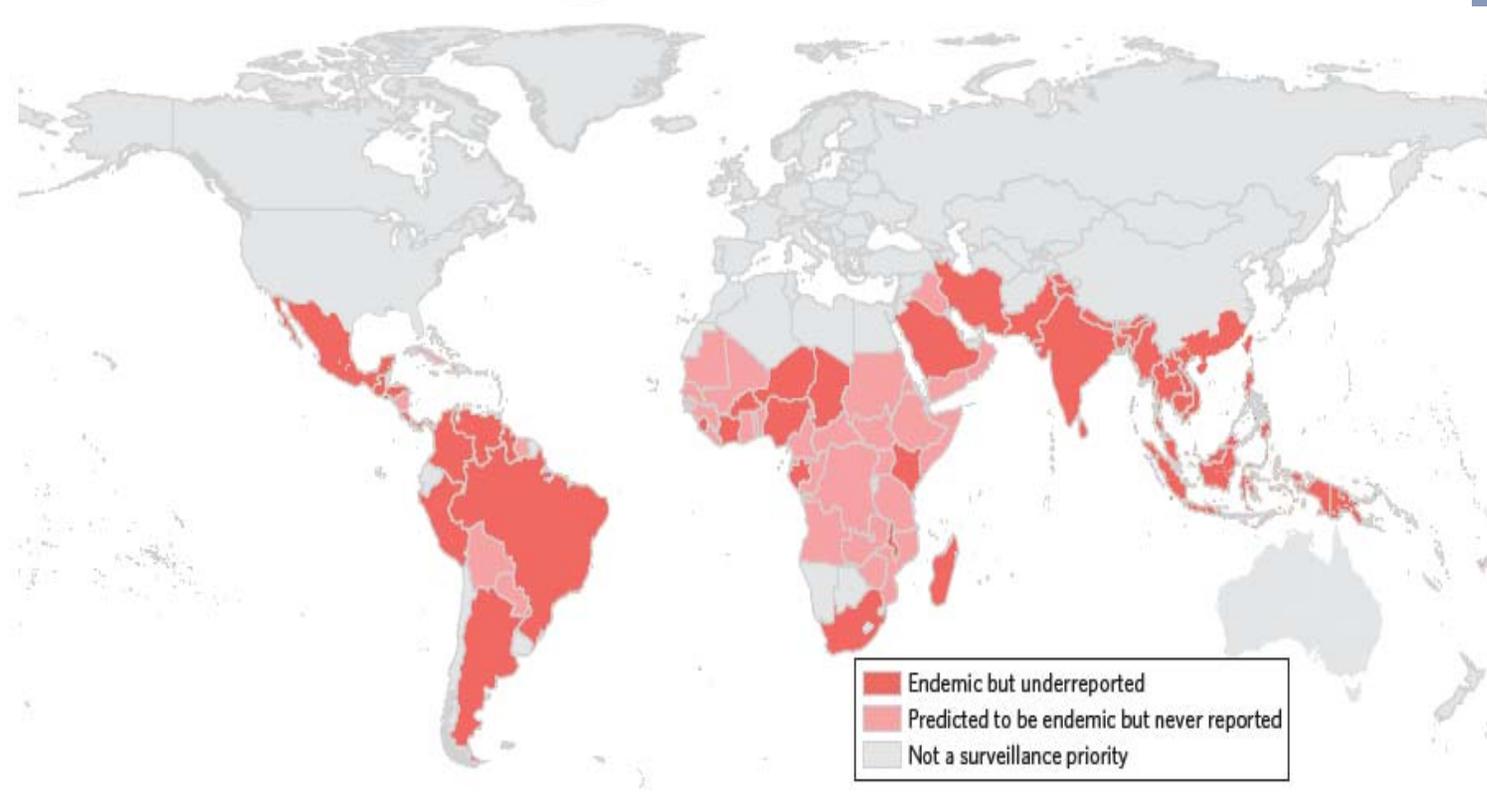
15

# Diabetes dynamic model



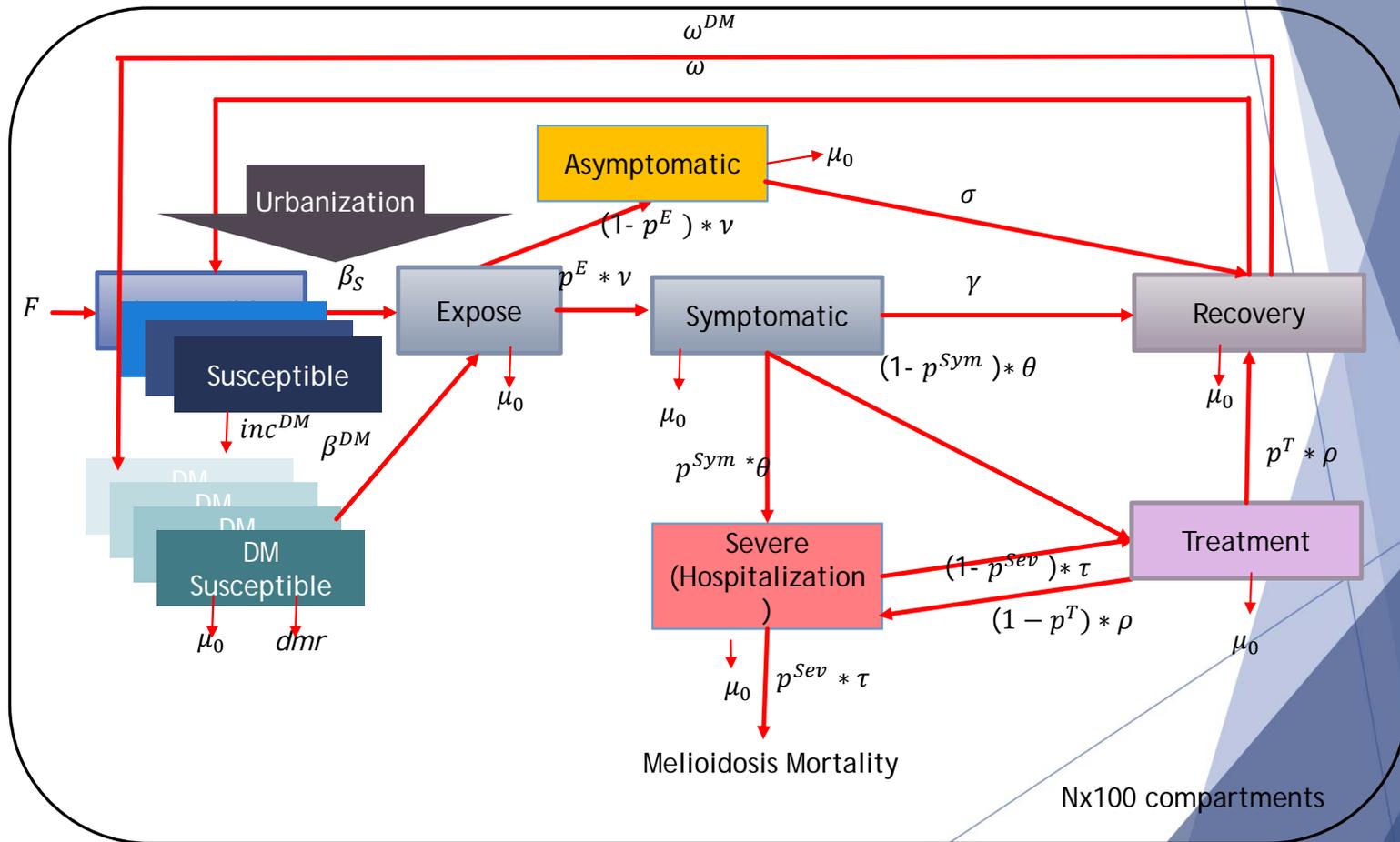
# Global Distribution of Melioidosis

Global evidence consensus and geographic locations of occurrence melioidosis data from 1910 to 2014.



Direk Limmathurotsakul, et al 2016

# Melioidosis transmission model



# Acknowledgements

- ▶ Mathematical And Economic MODelling group (MAEMOD, MORU) (Lisa White, Ben Cooper, Ricardo Aguas)
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