



National Institute for Public Health
and the Environment
Ministry of Health, Welfare and Sport



Arbovirus outbreak
preparedness and
response

European and global arbovirus surveillance systems

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Ministry of Health, Welfare and Sport



Content

1. Risk versus burden
2. Surveillance strategy
3. Virus surveillance in vectors
4. Take home messages



1. Disease burden versus threat

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Disease burden vs threat



Different types of VBD context

based on the current presence (✓) or absence (-)

Context	Endemic disease	Pathogen	Vector	Examples of diseases holding for the Netherlands	
					Disease burden
2	-	✓	✓	Dirofilariasis	
3	-	-	✓	West Nile Fever	
4	-	✓	-	Leishmaniasis	Threat
5	-	-	-	Crimean Congo haemorrhagic fever	

* Endemic infections with human cases.



2. Surveillance strategy

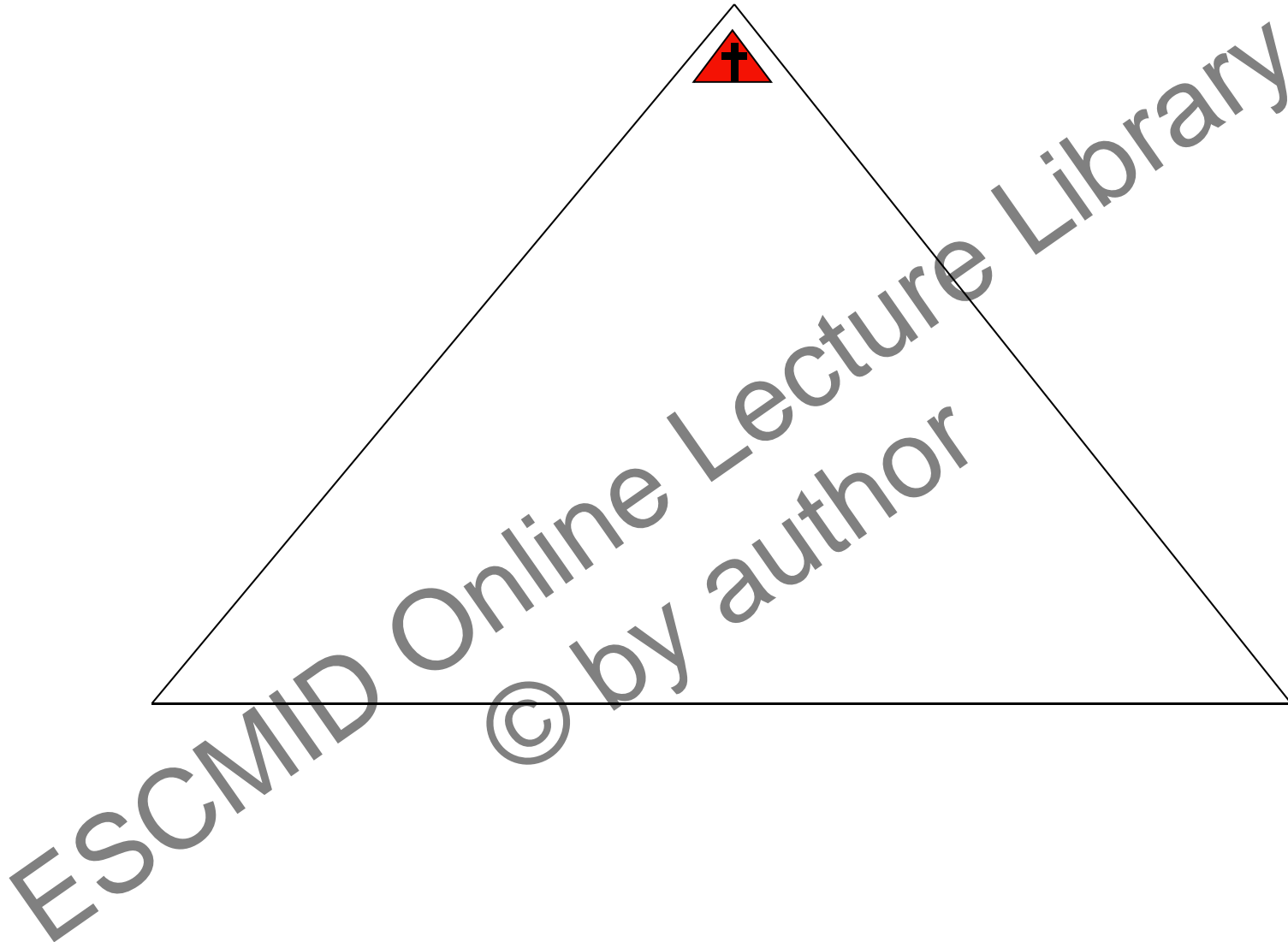
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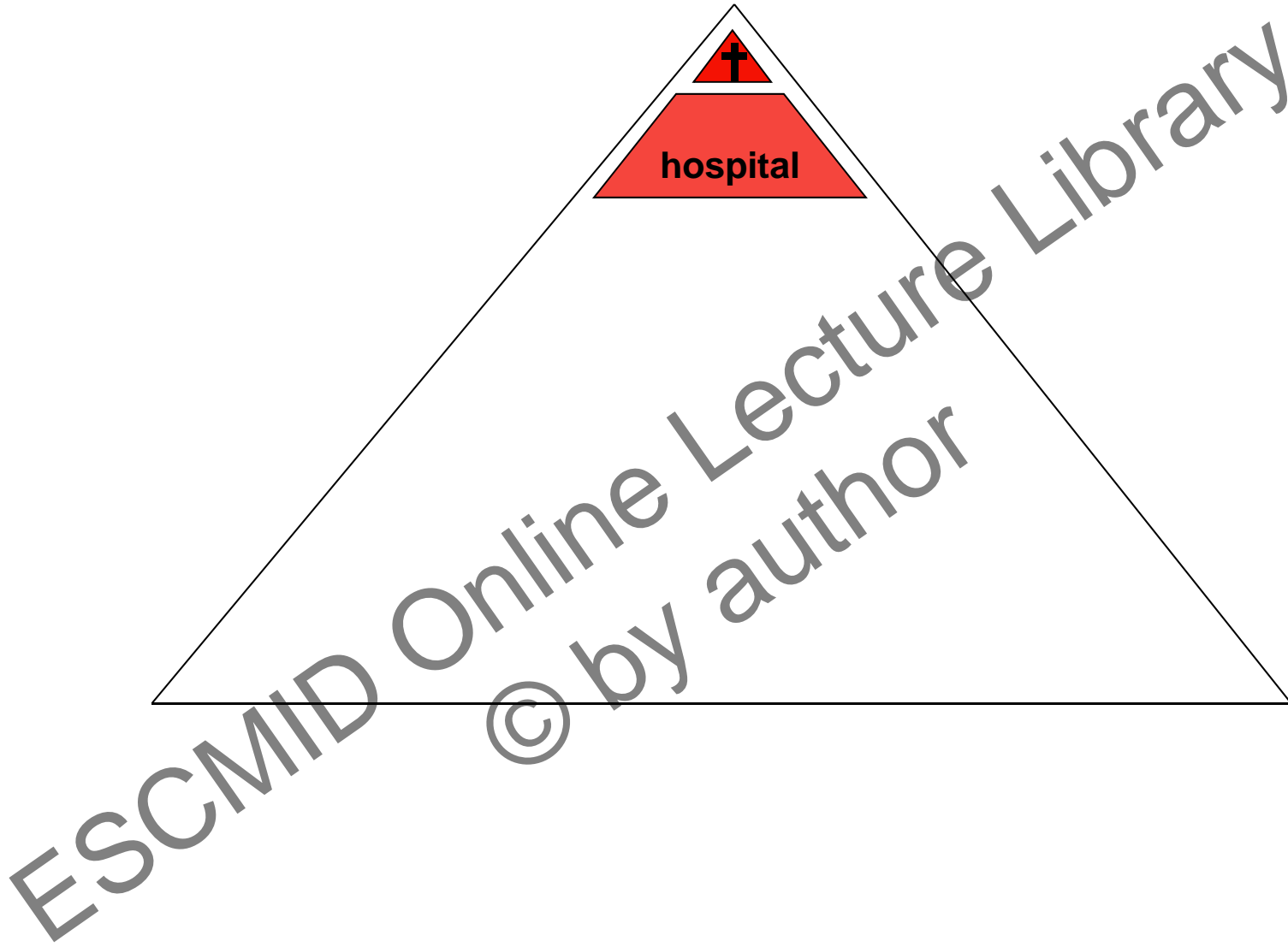


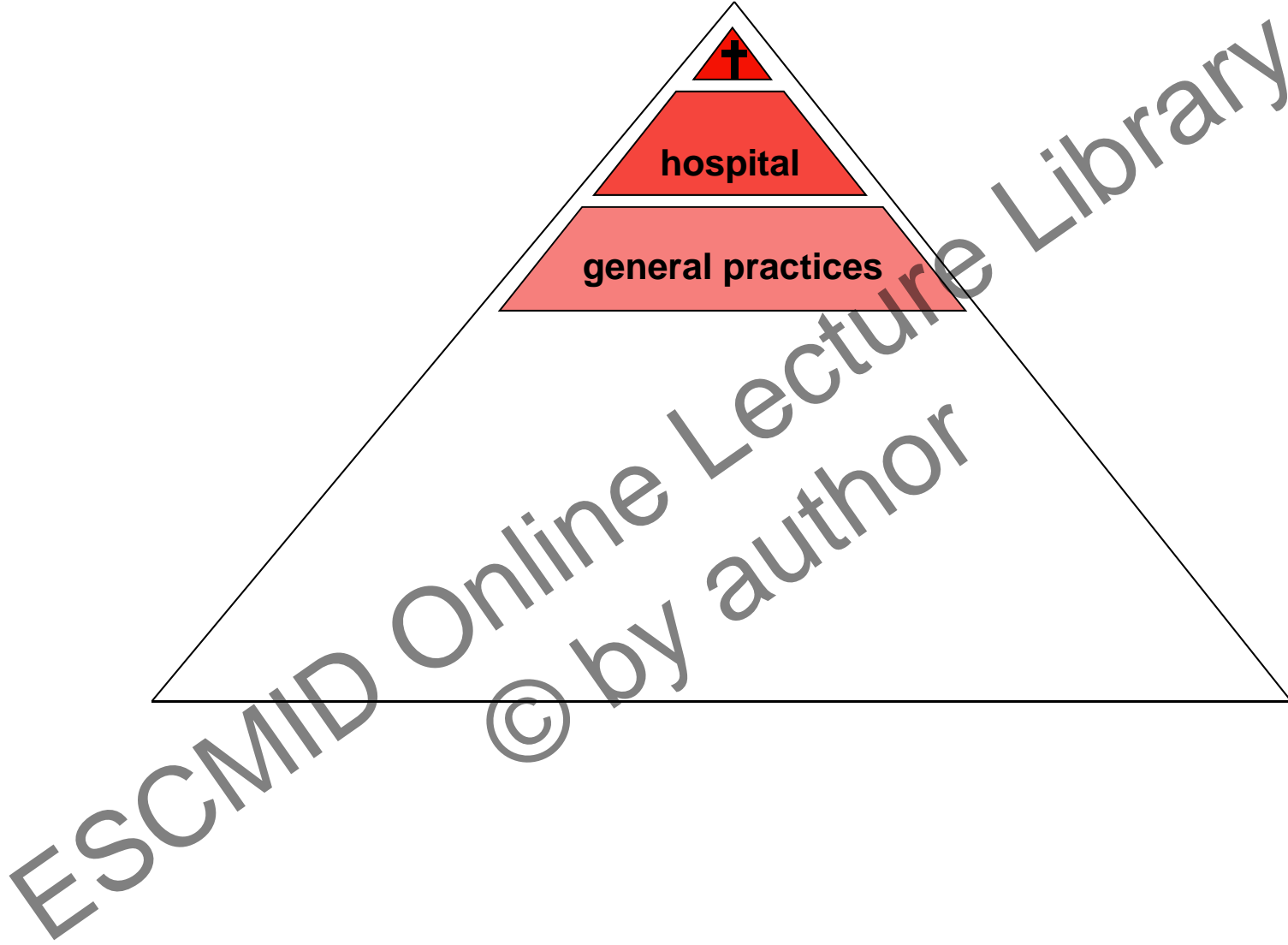
Data collection

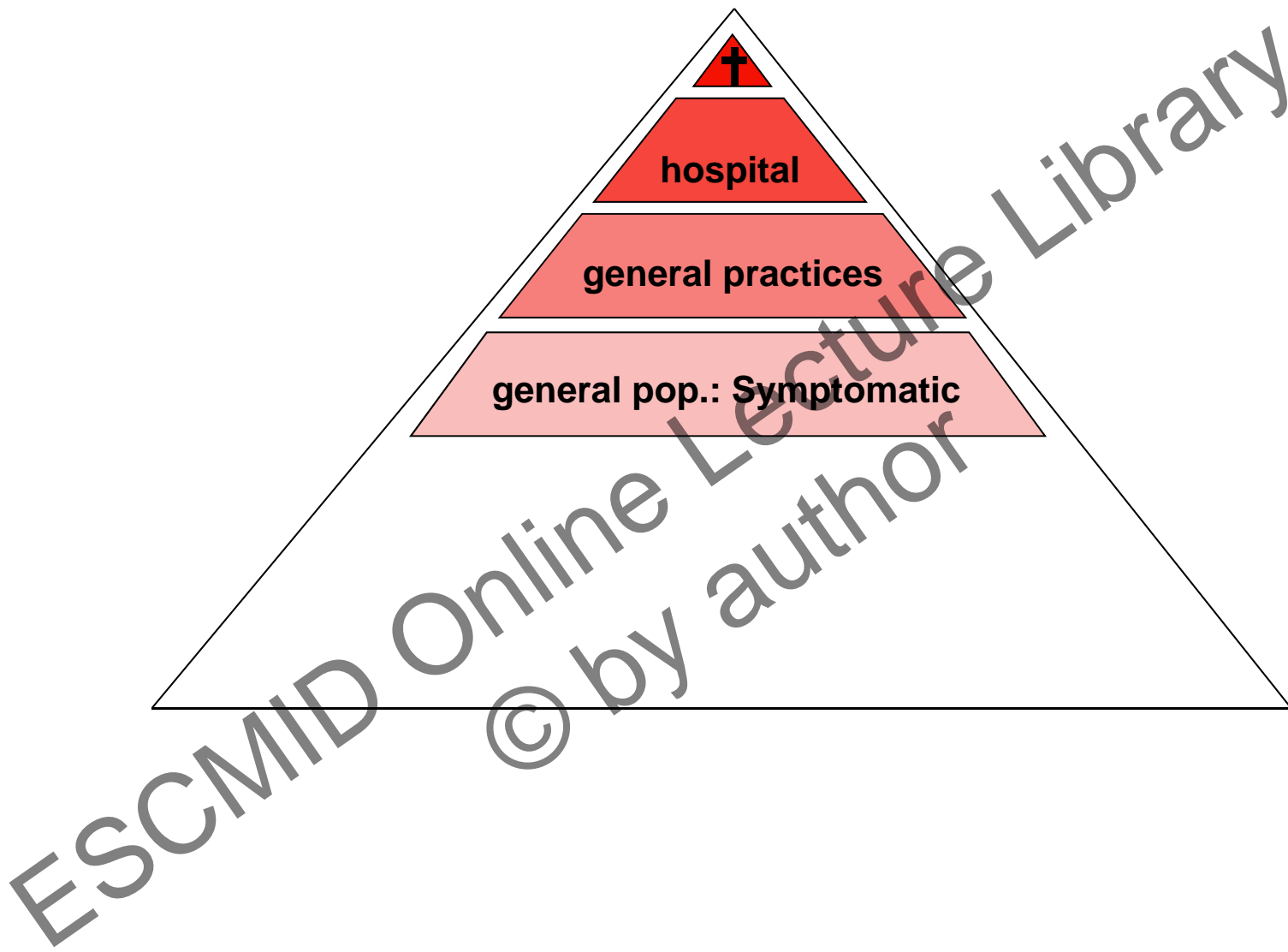
- Pathogen data collection.
- Serological data collection.
- Clinical data collection.
- Syndromic data collection.
- Risk data collection.

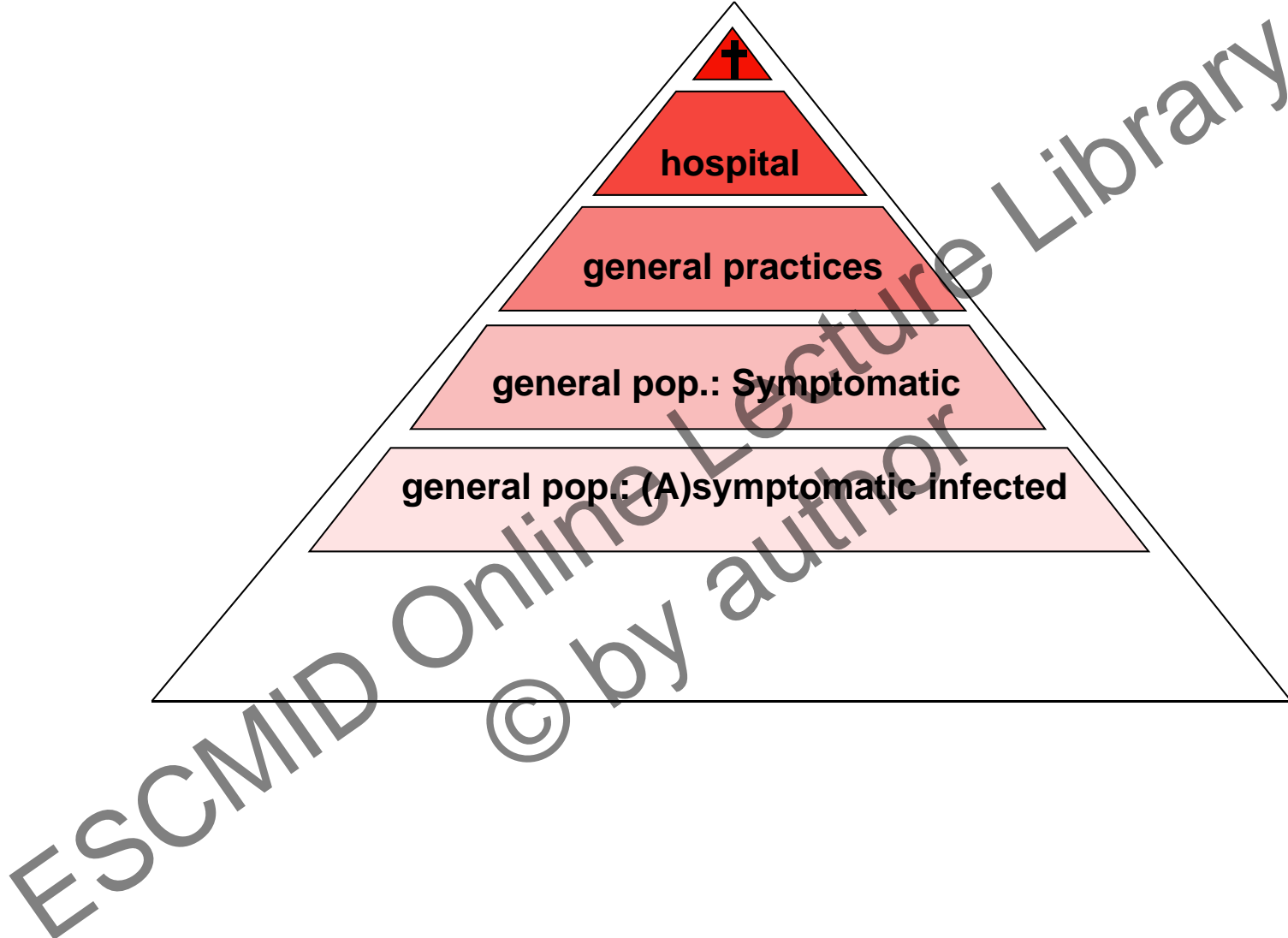
Surveillance information leads to decision to take action
Not taking action should be a decision

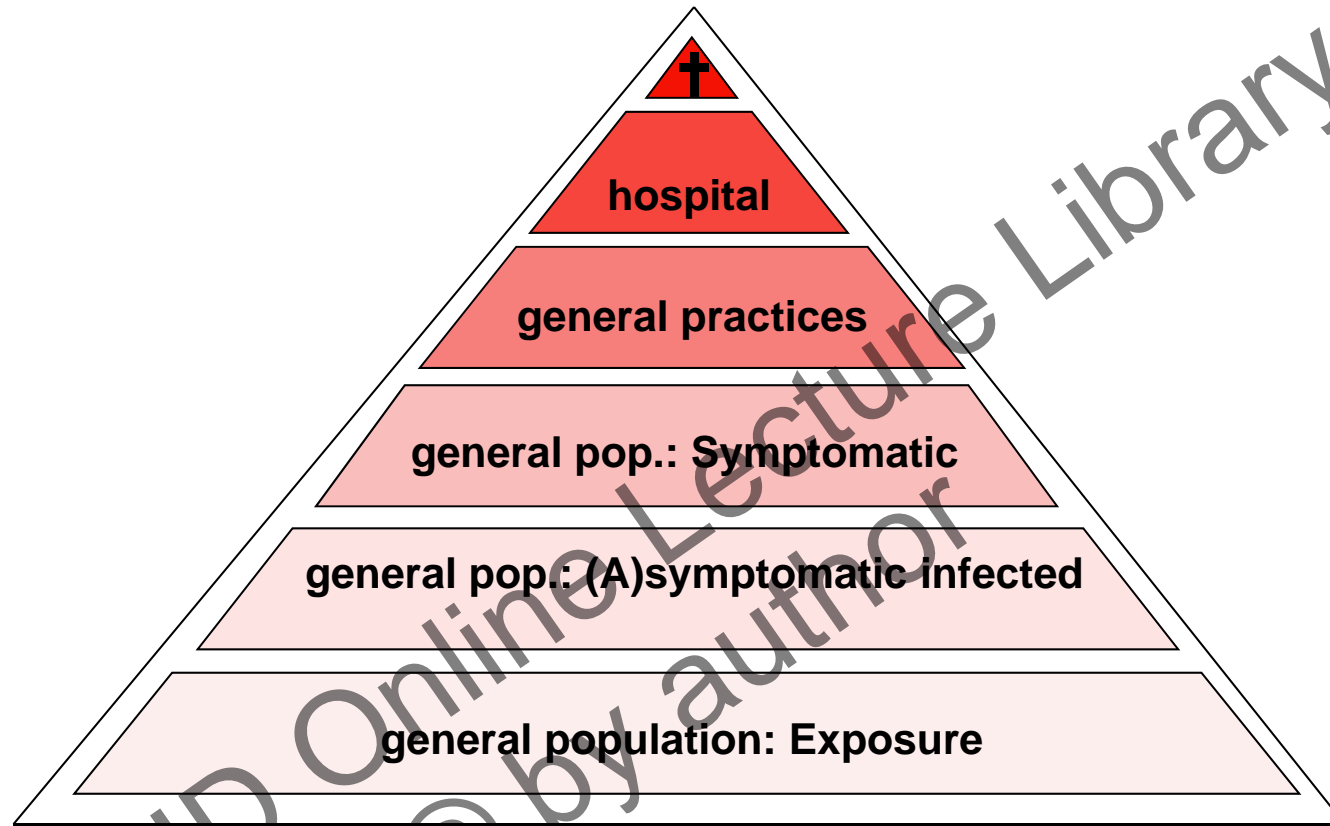


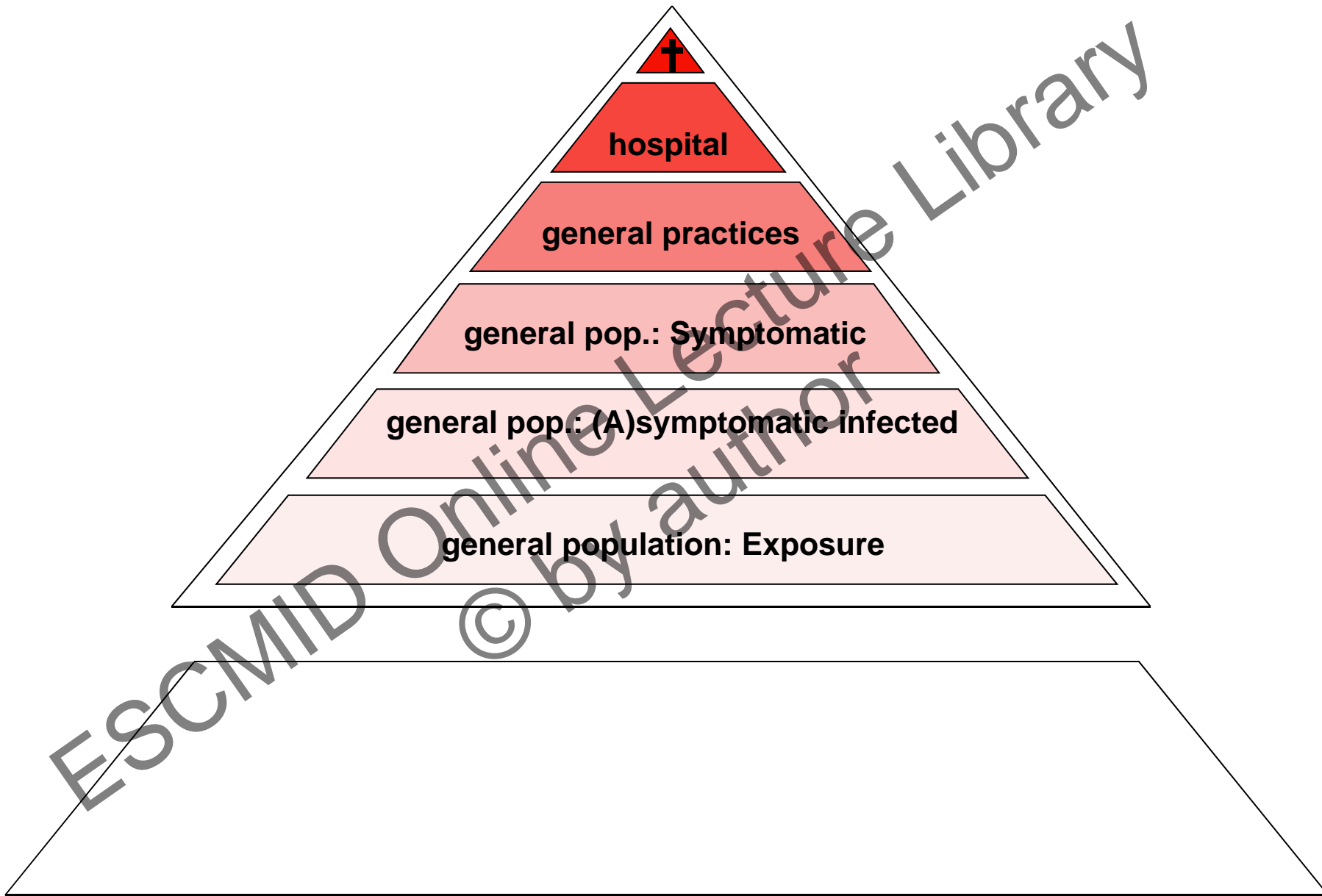


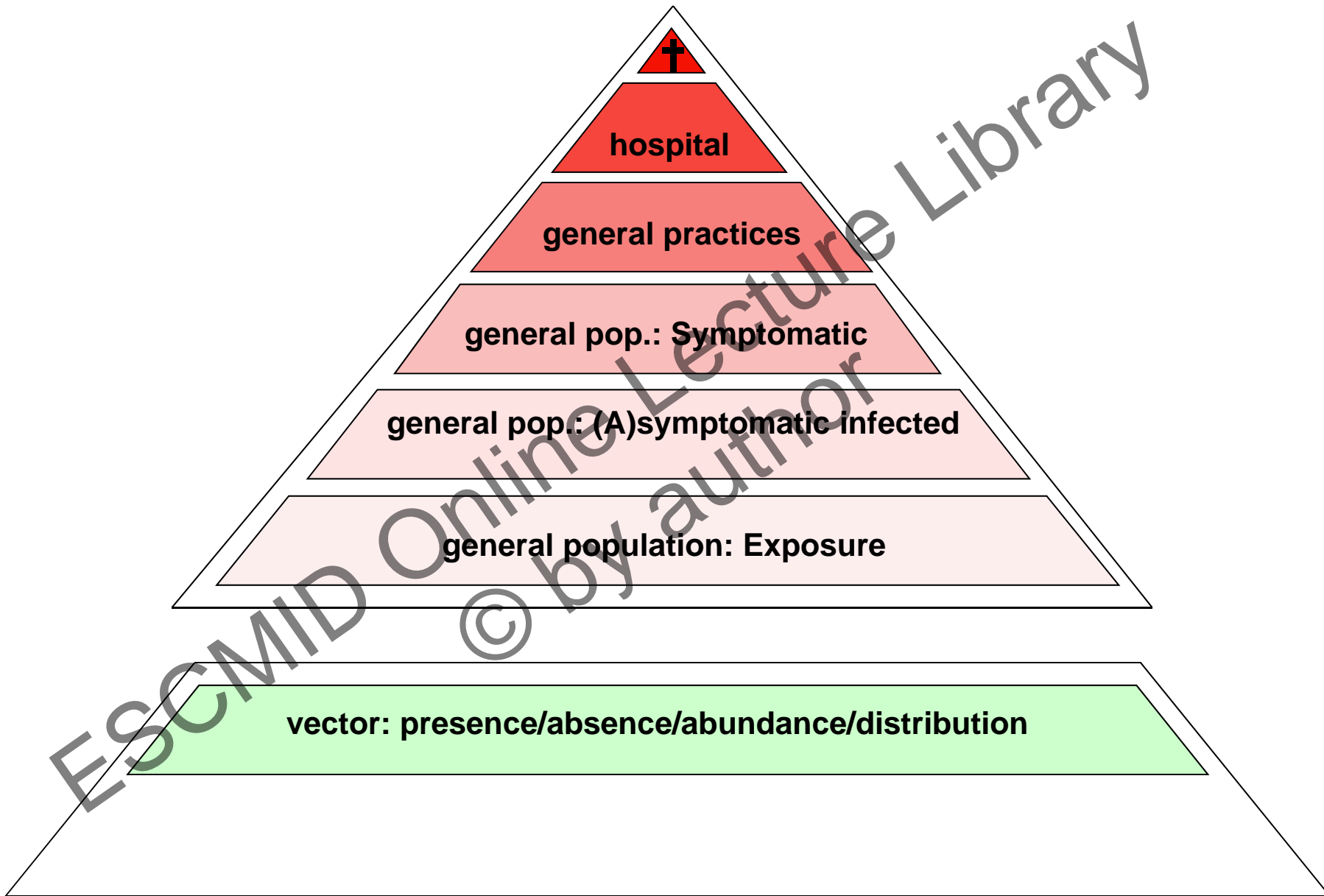


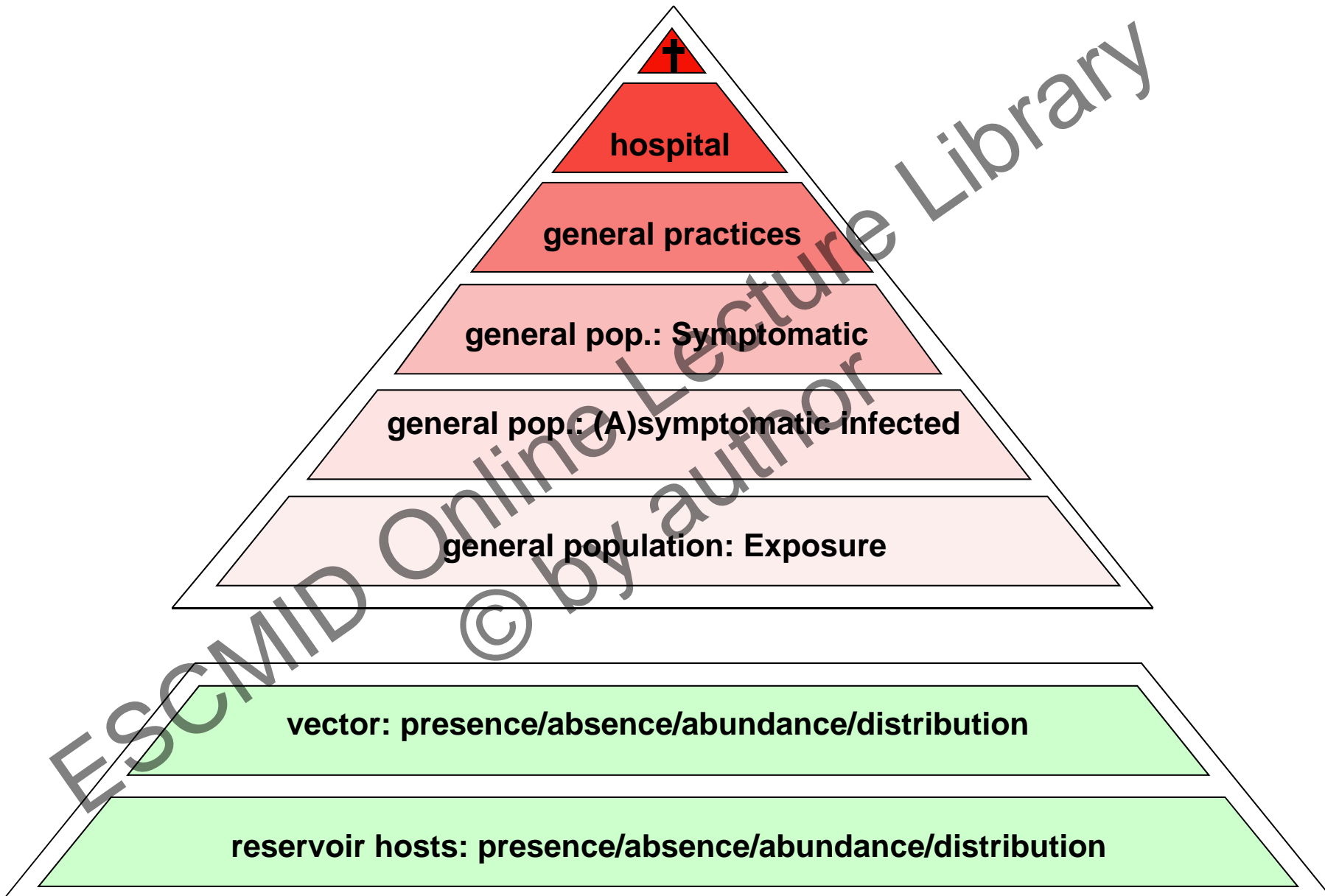


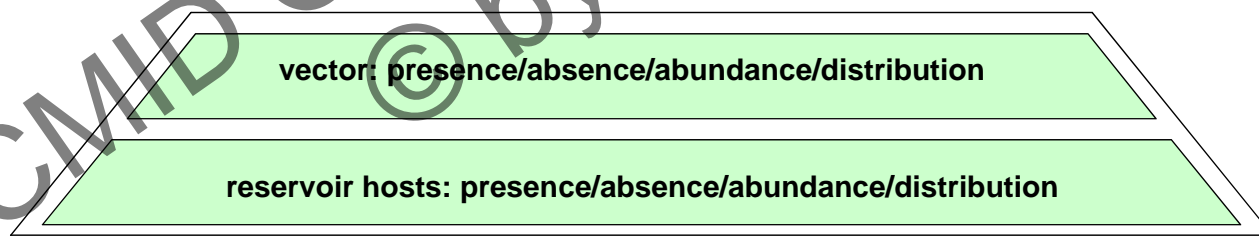
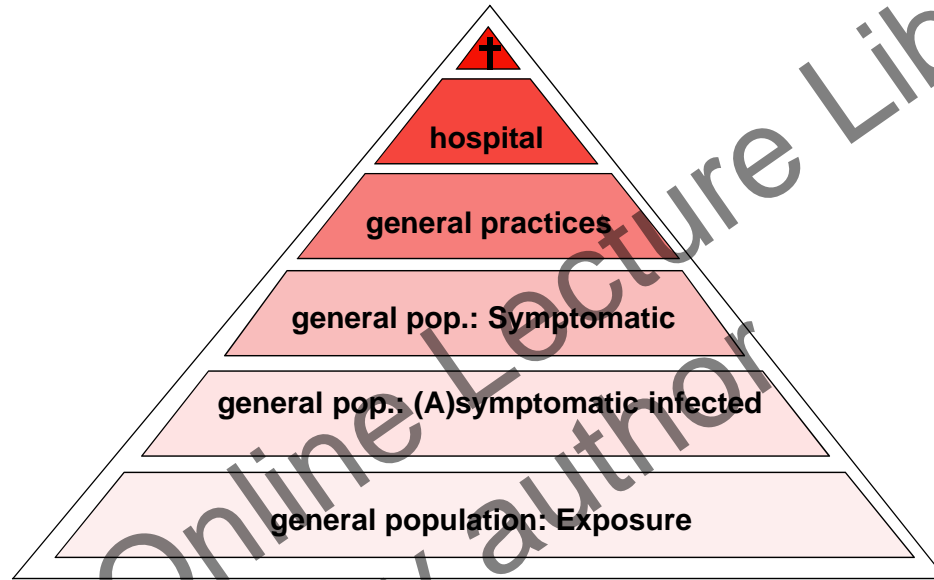




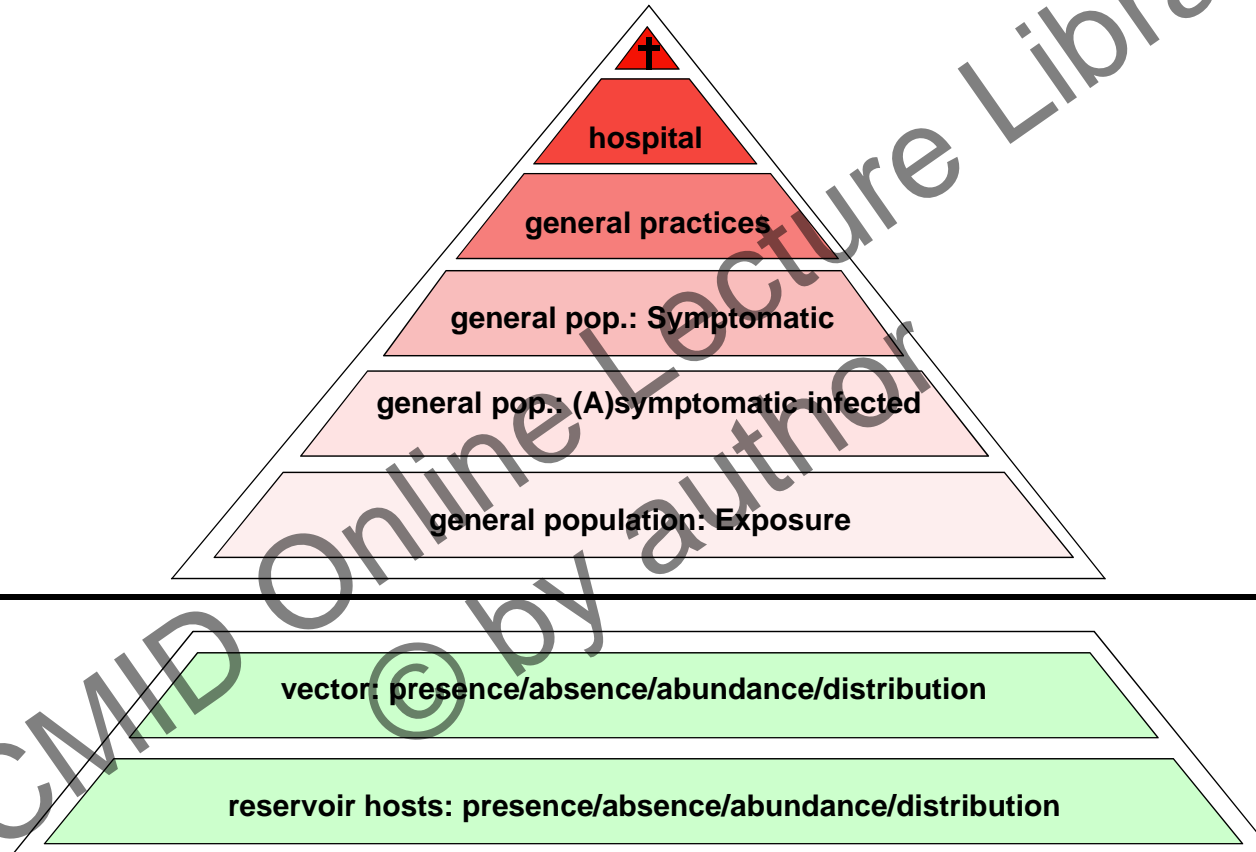




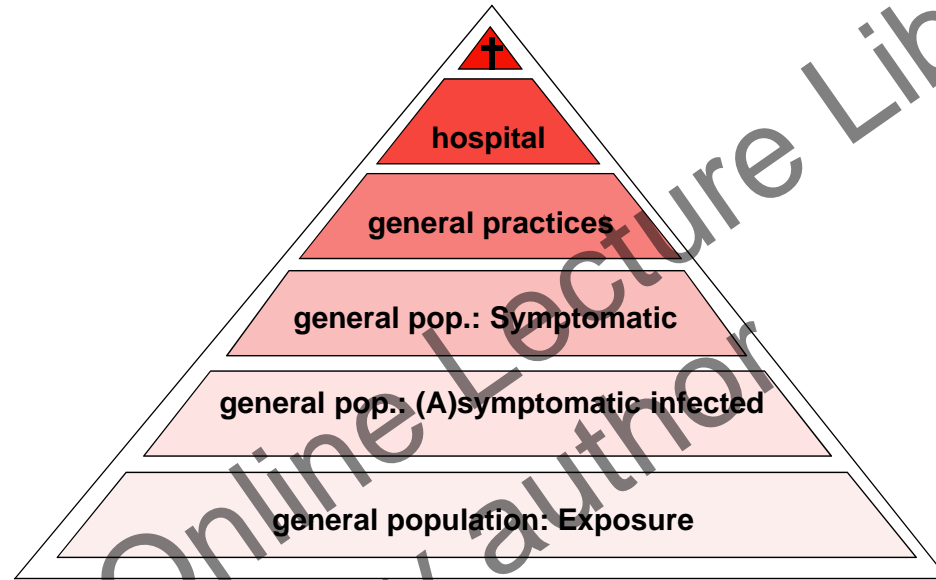




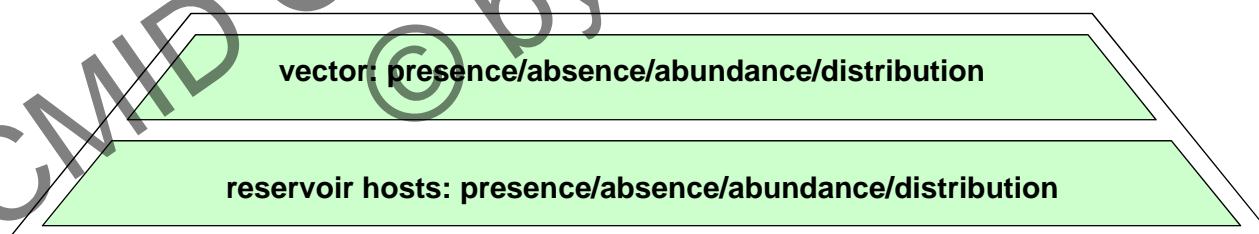
Disease burden



Disease burden

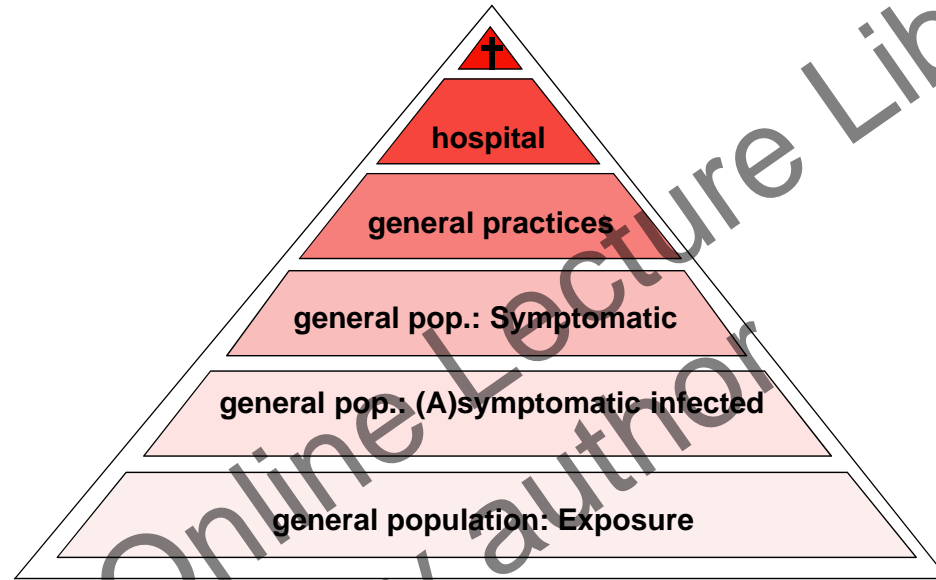


Threat

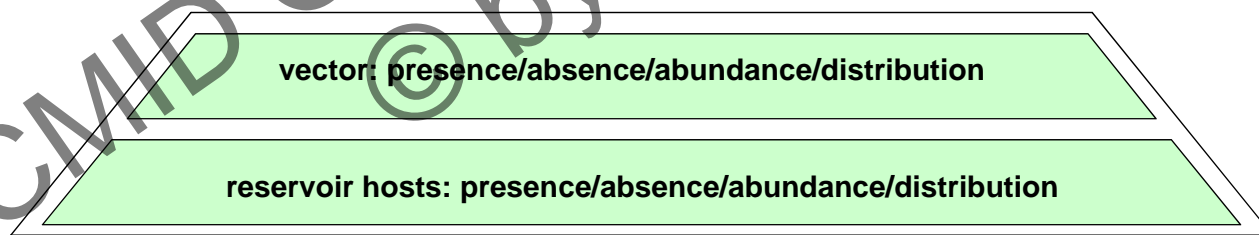


Surveillance

Disease burden



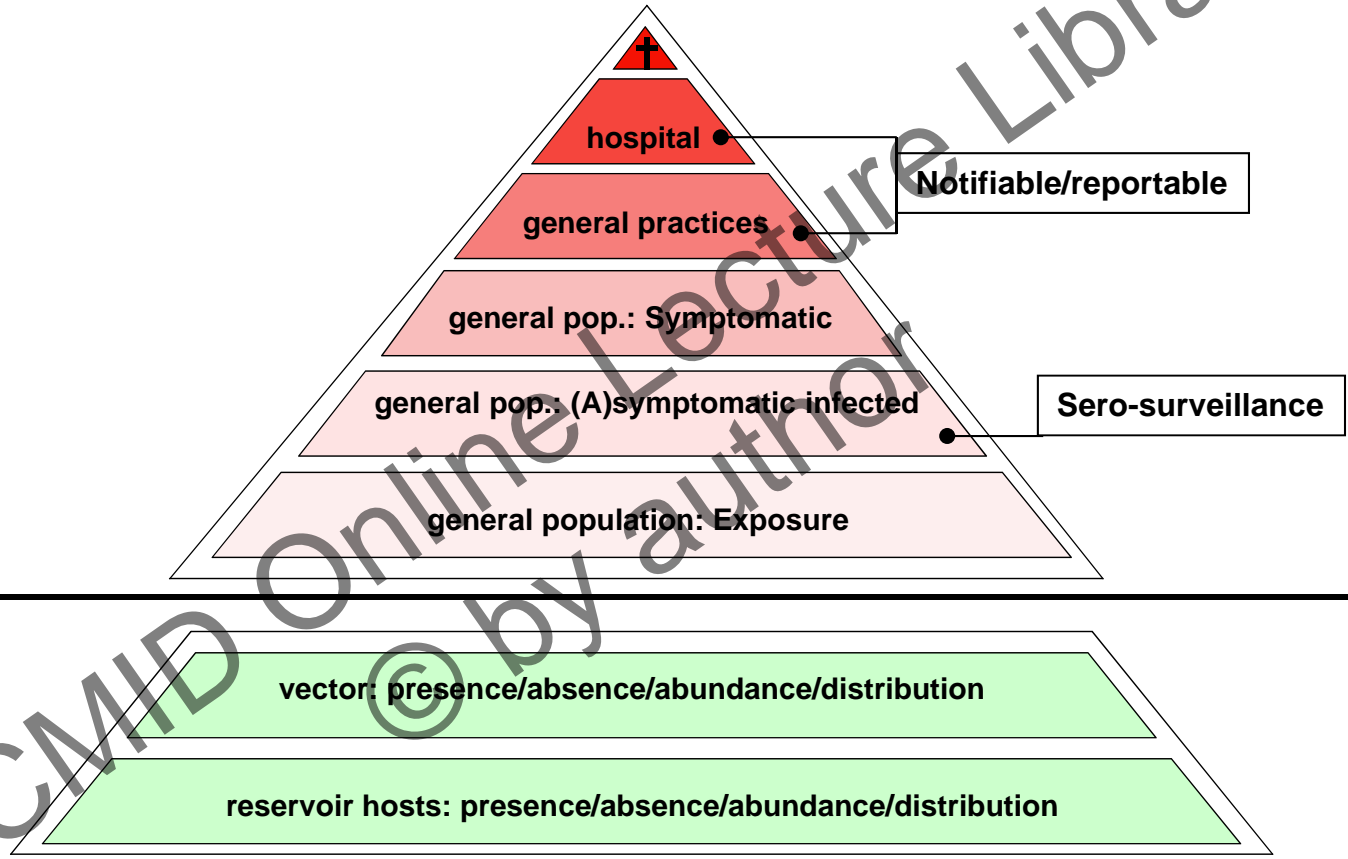
Threat



Disease burden

Threat

Surveillance

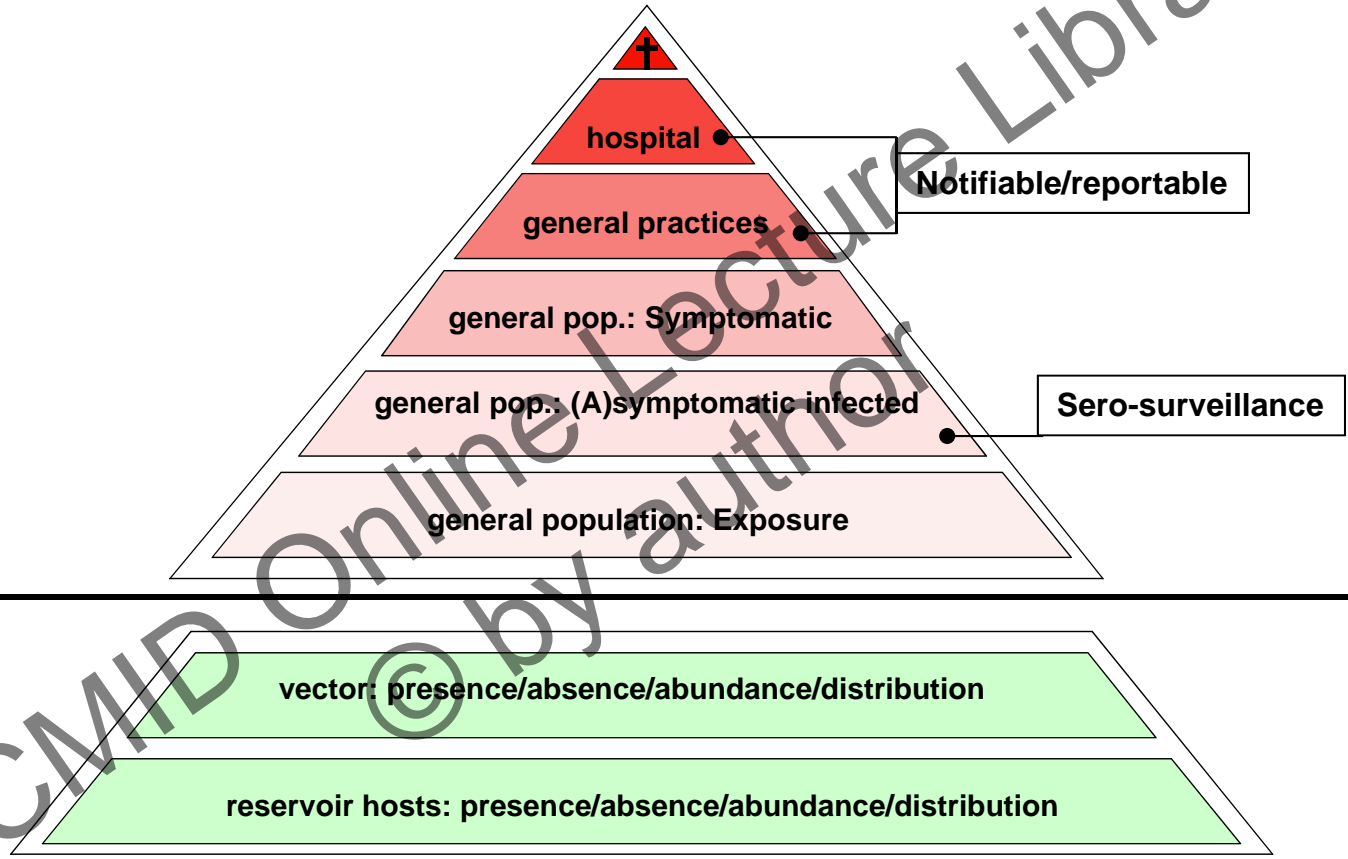


Intervention

Surveillance

Disease burden

Threat

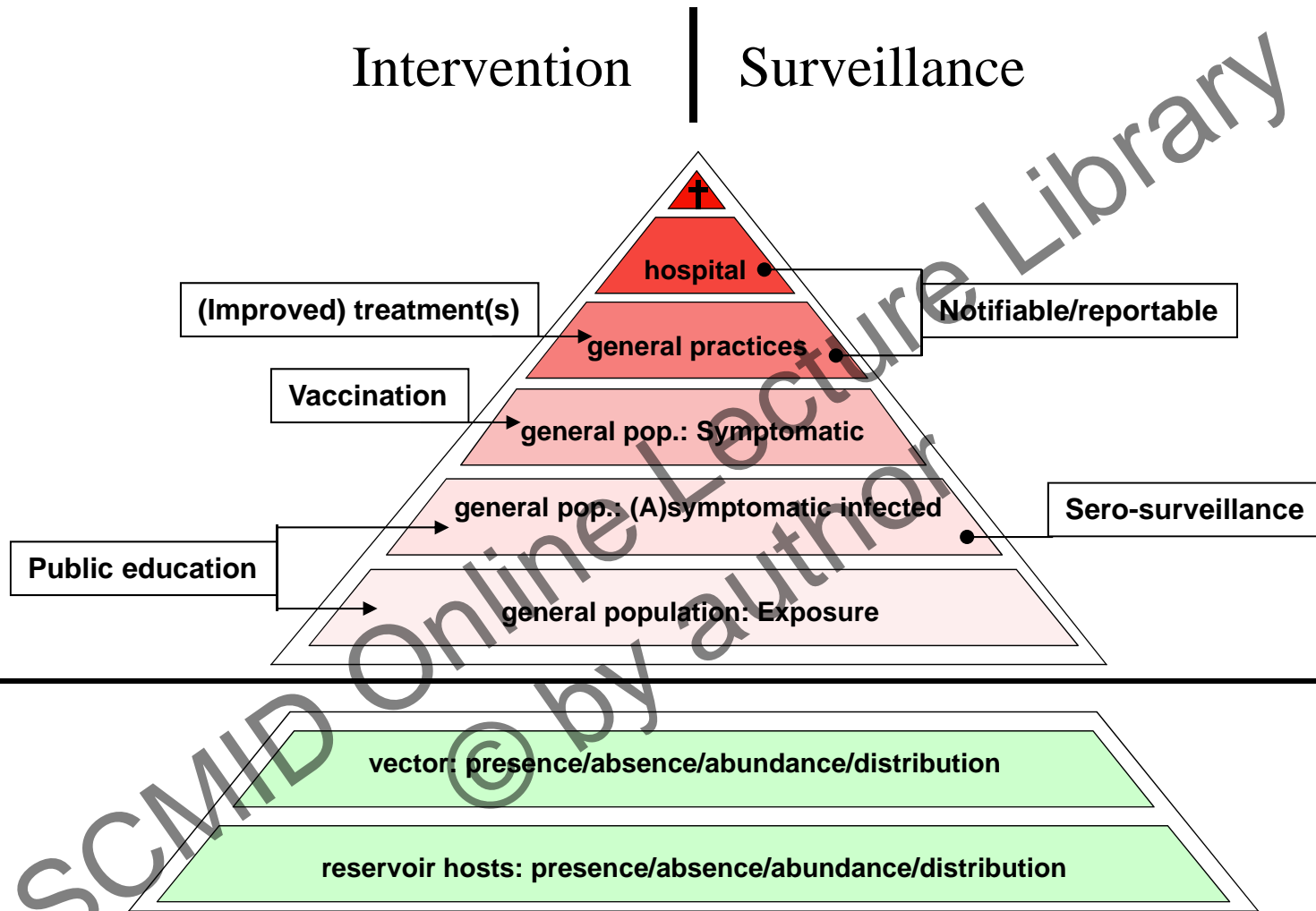


Intervention

Surveillance

Disease burden

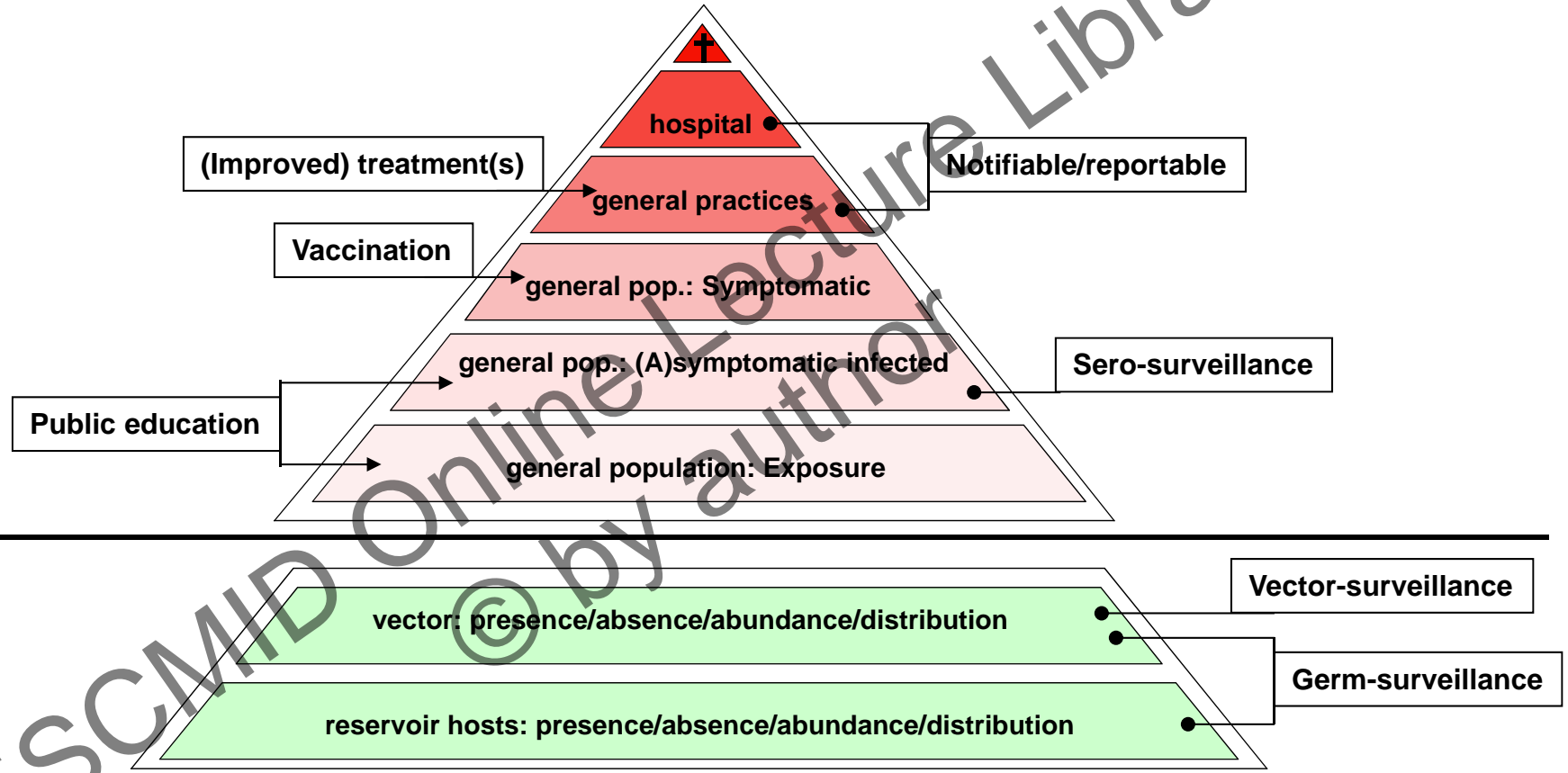
Threat

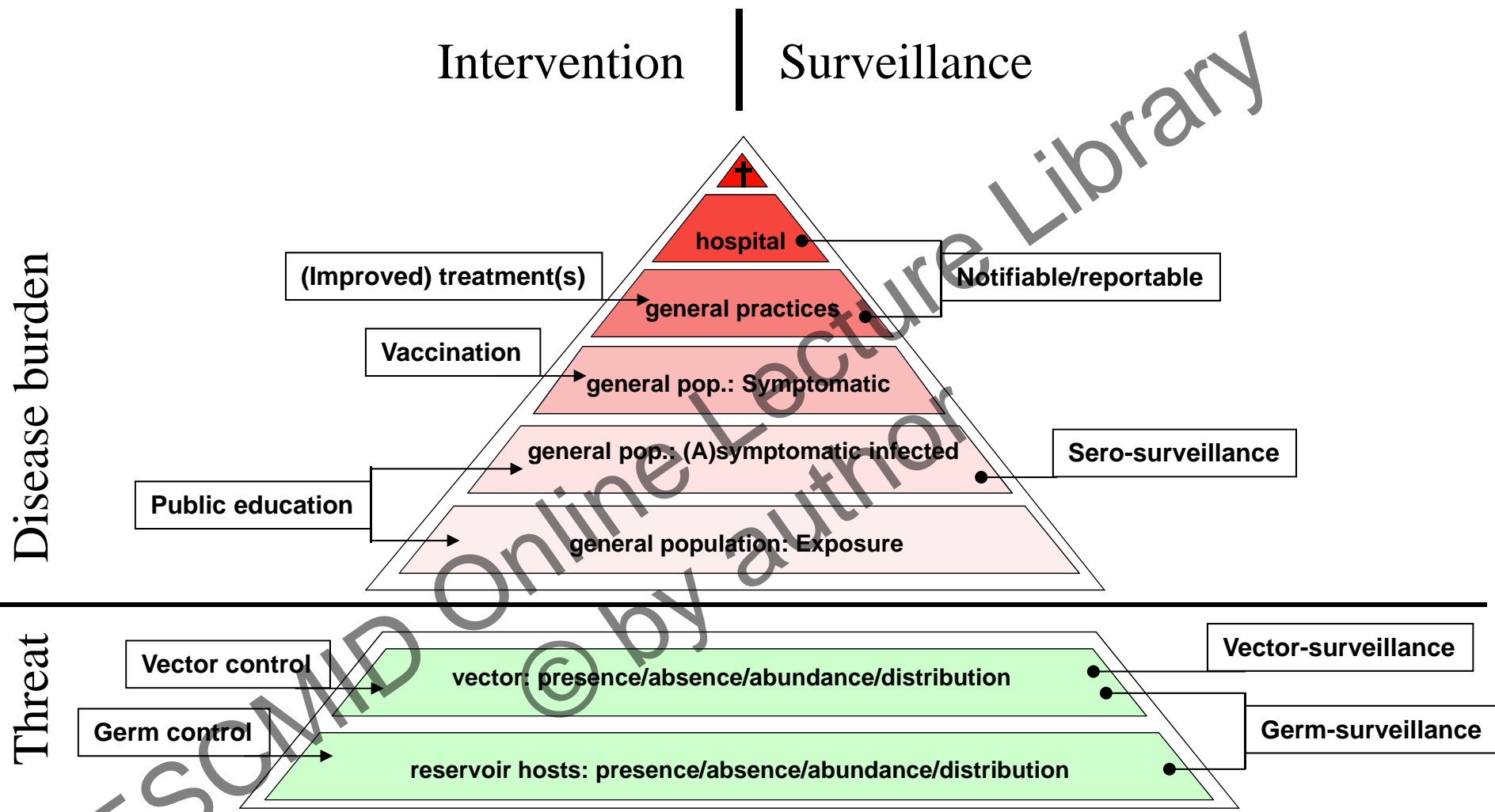


Disease burden

Intervention

Surveillance

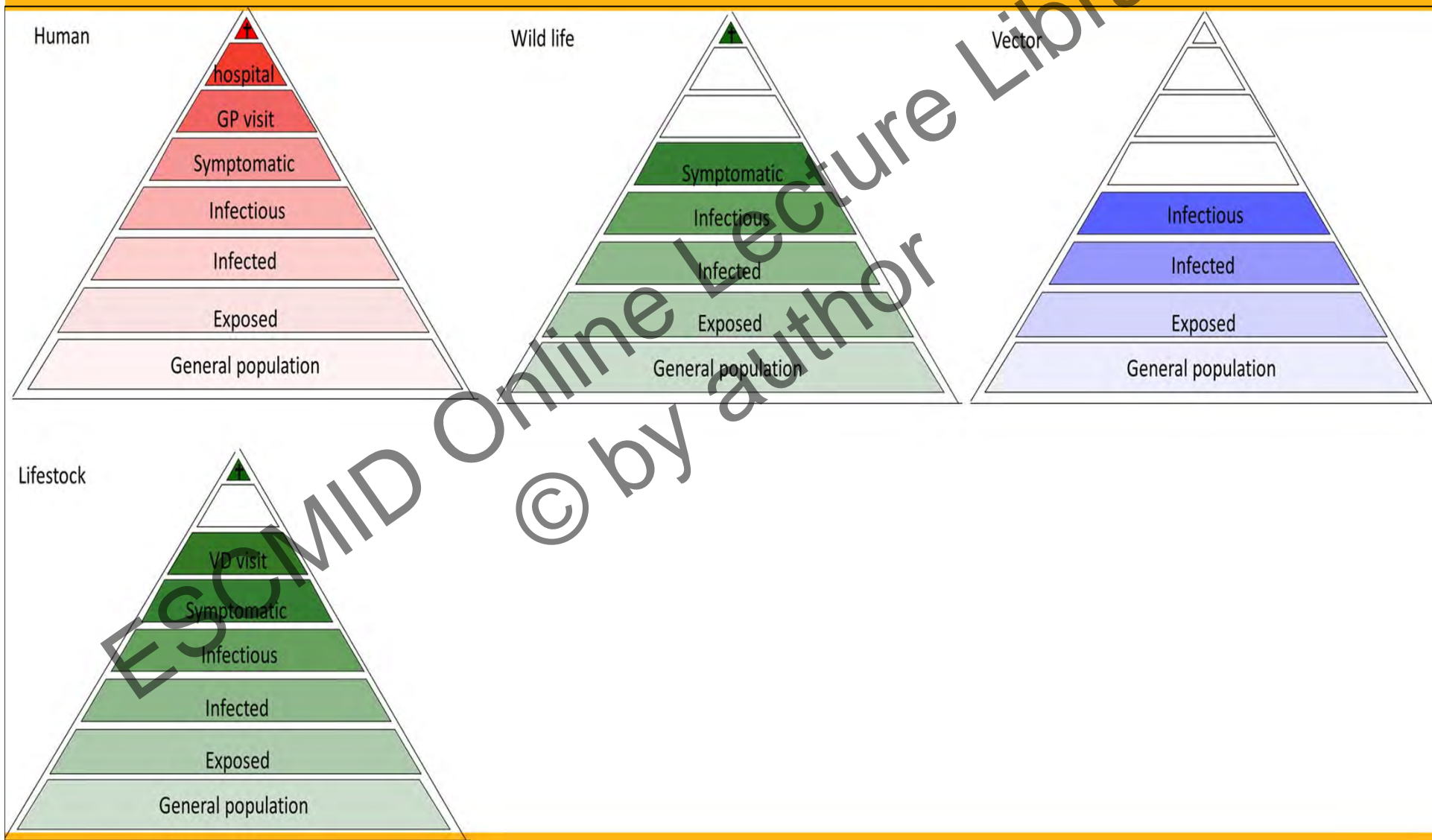




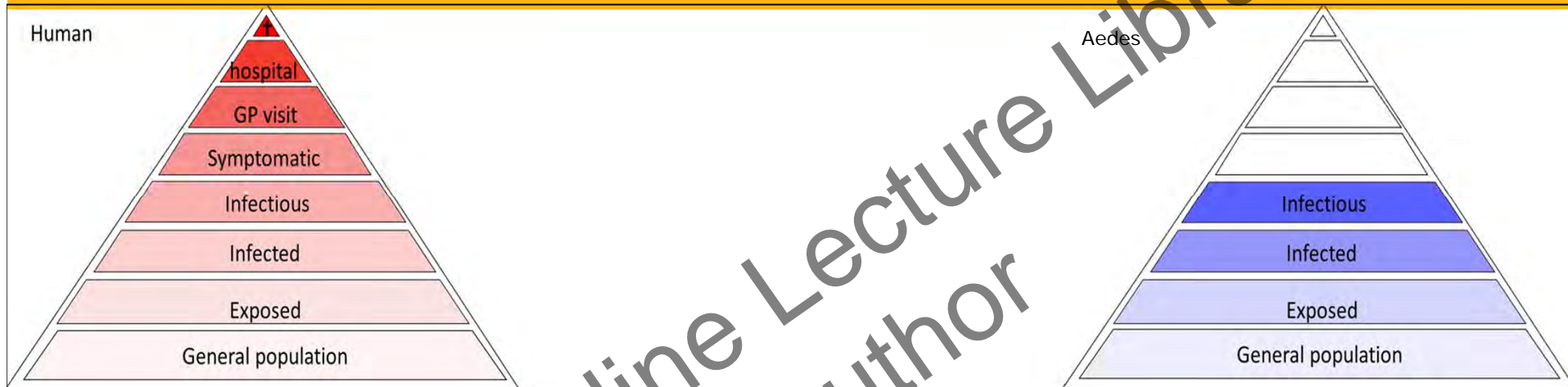
Actually not one pyramid, but a pyramid assembly



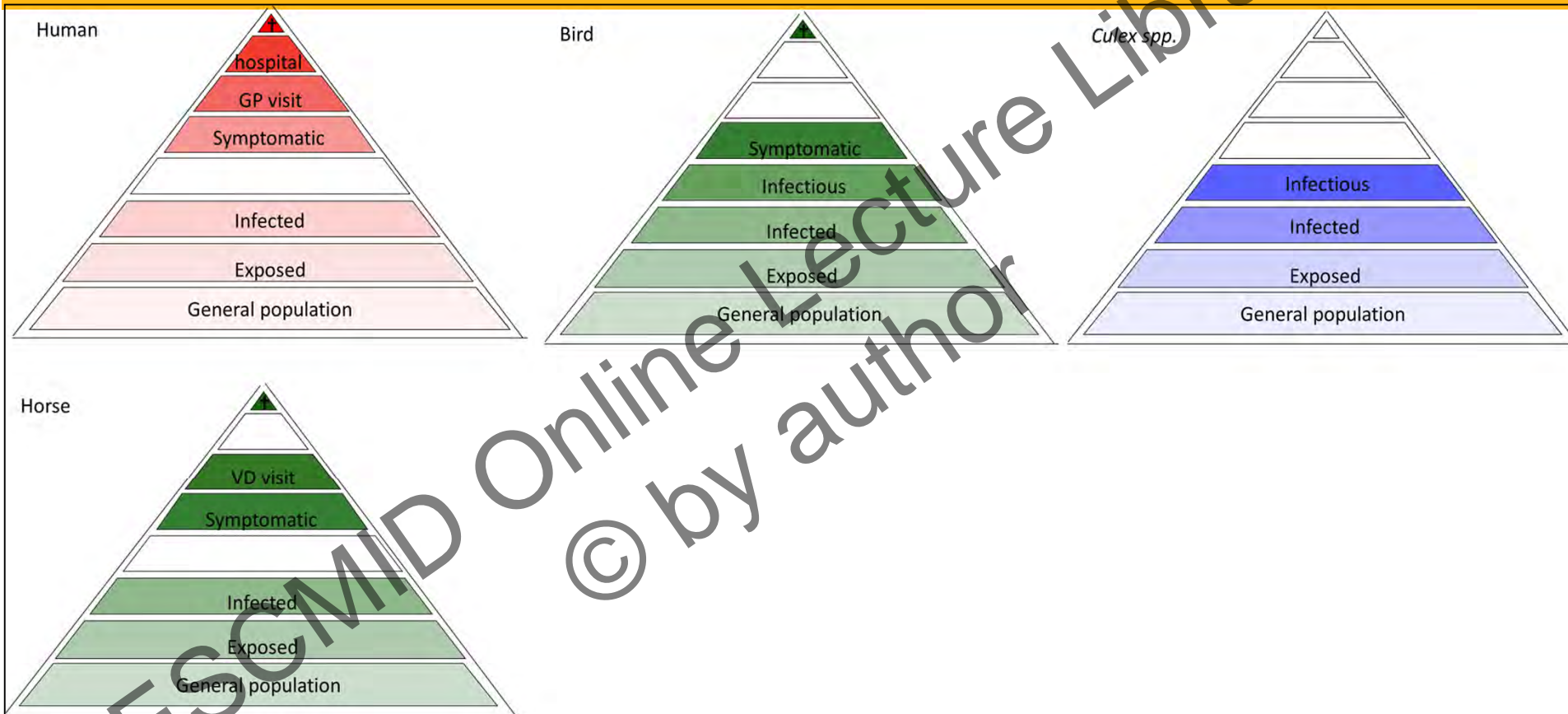
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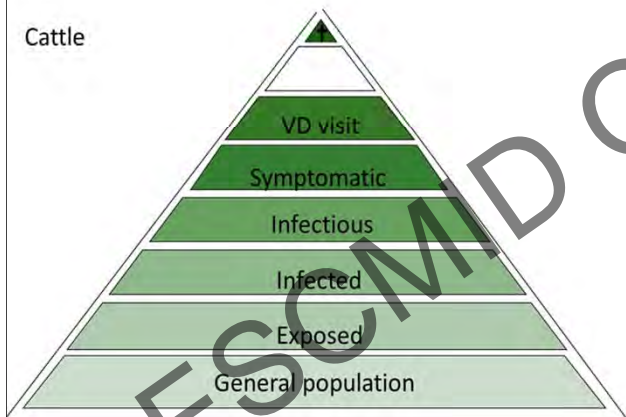
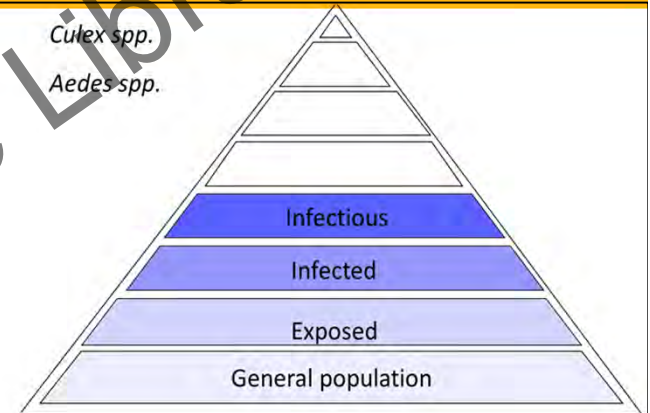
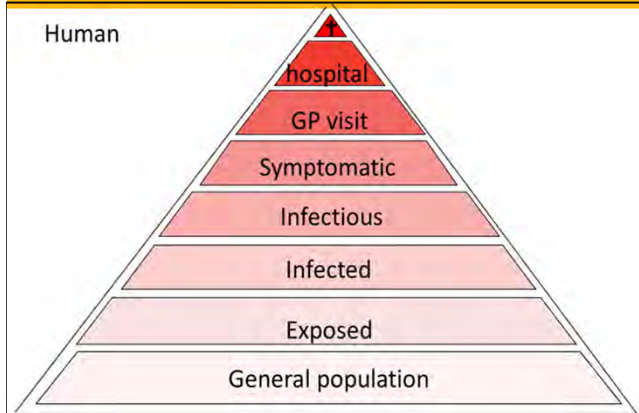
Zika



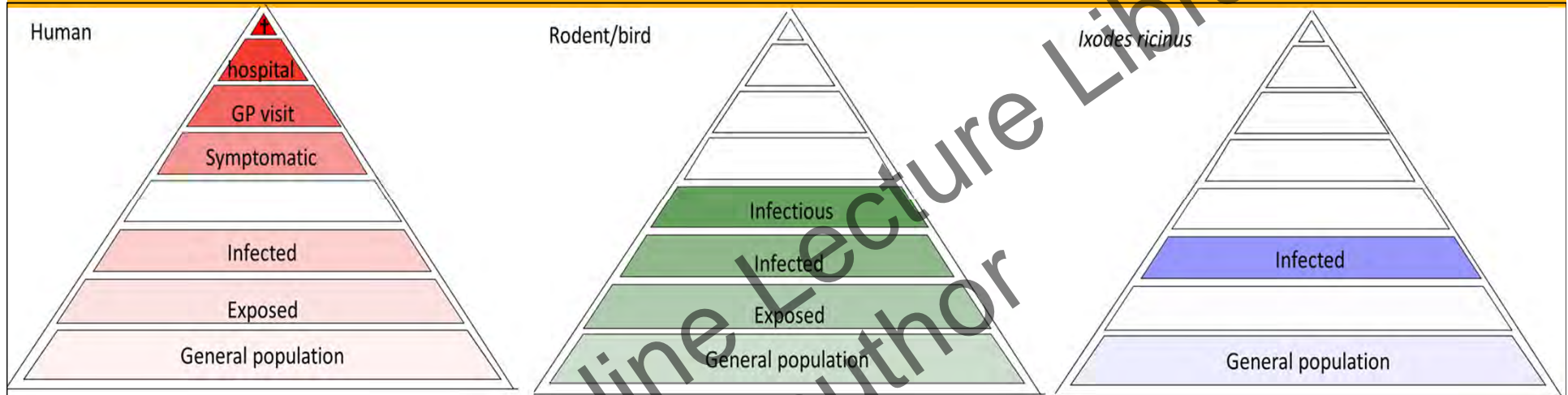
WEST NILE FEVER



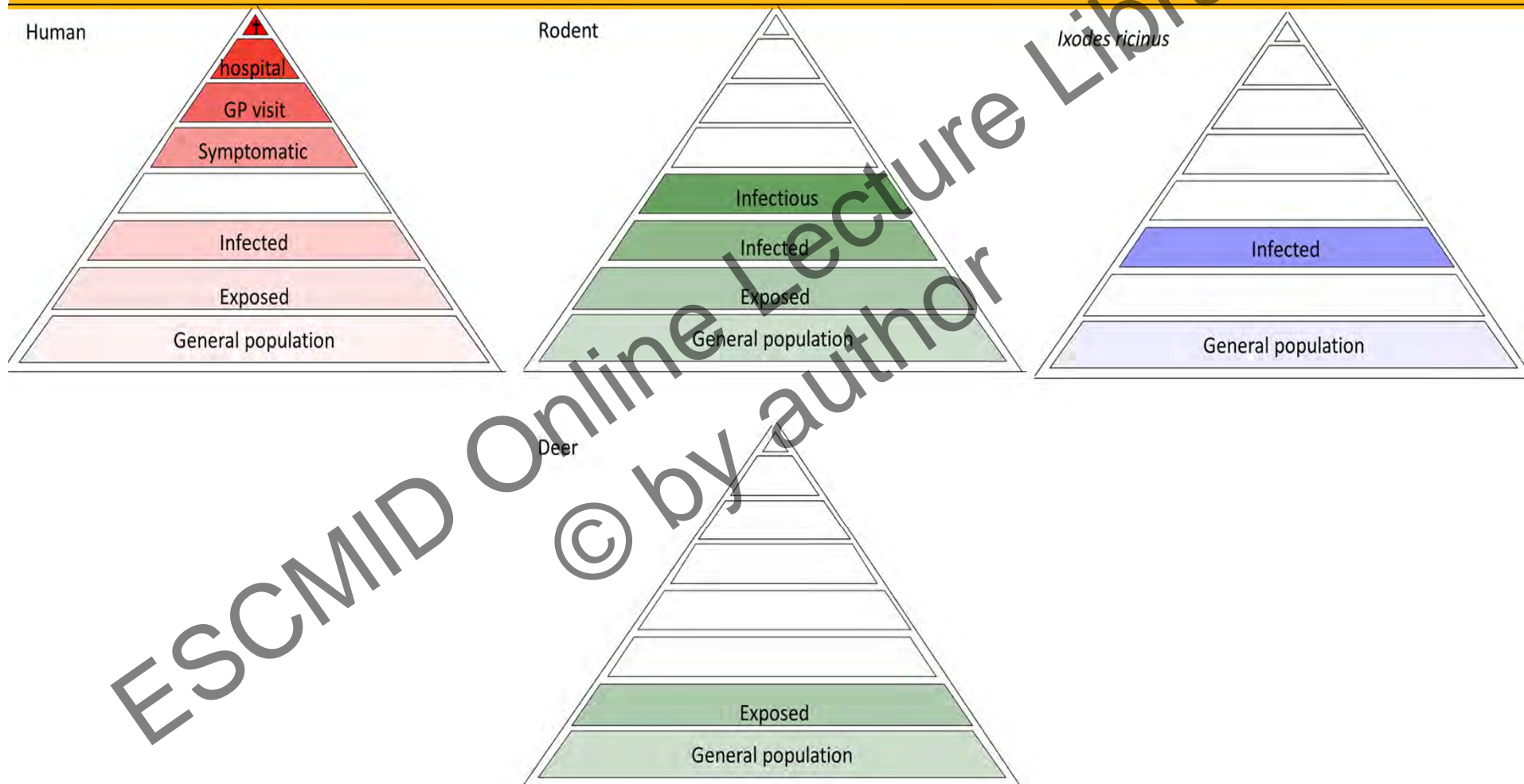
RIF VALLEY FEVER



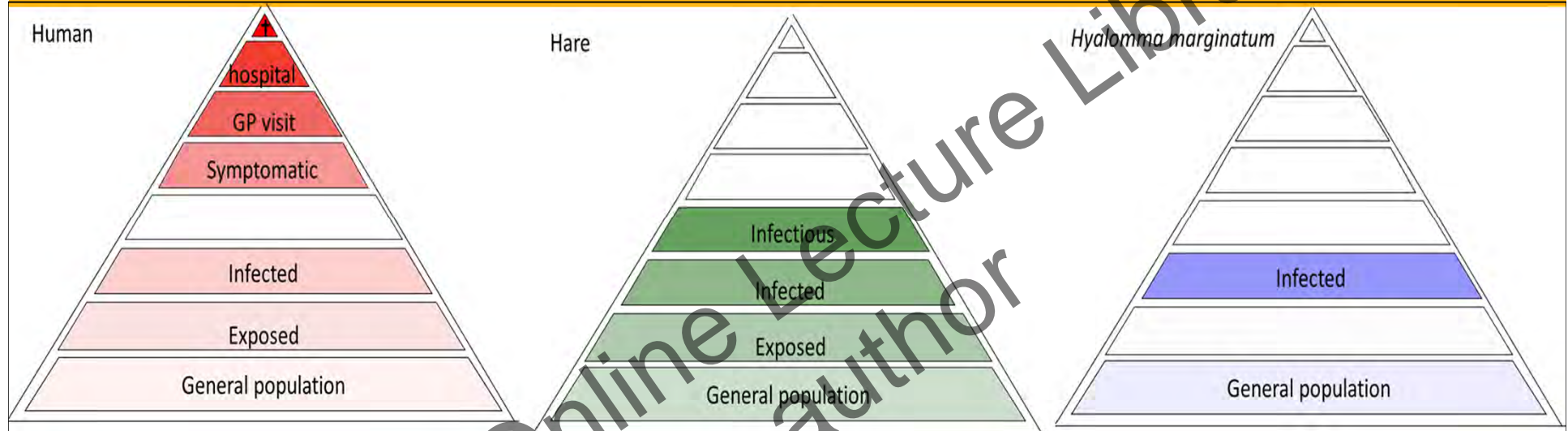
LYME



TICK BORNE ENCEPHALITIS



Crimean Congo Haemorrhagic fever



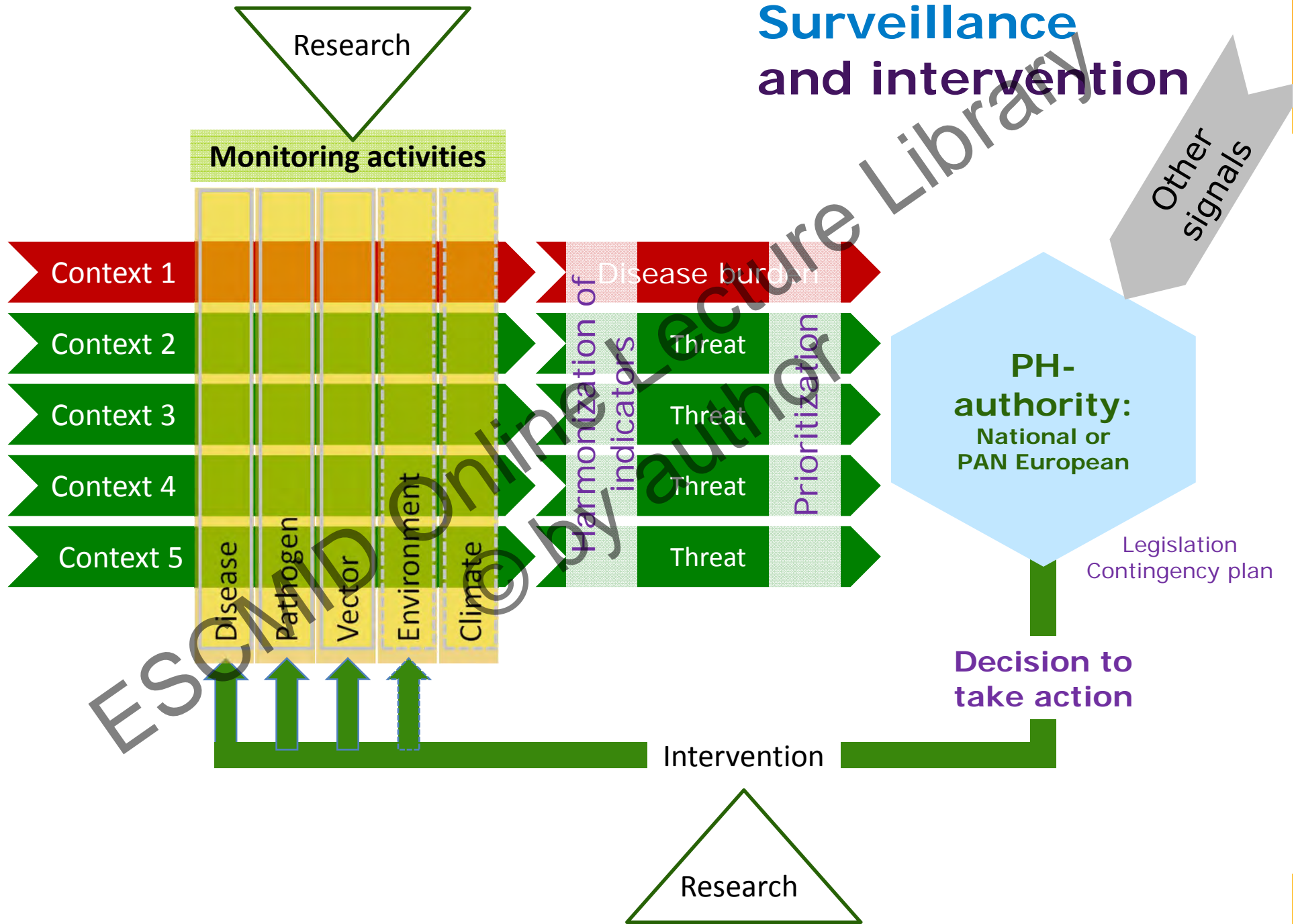


Surveillance and intervention



Legislation
Contingency plan

Surveillance and intervention





Surveillance and intervention

Essential data per member state?

Country x	VBD
	Context
Mosquito-borne diseases:	
Chikungunya	x
Dengue	.
West Nile Fever	.
Rift Valley Fever	.
Tick-borne diseases:	
Tick-borne encephalitis	.
Crimean-Congo haemorrhagic fever	.
Lyme borreliosis	.
Tularaemia	.
Rickettsiosis	.
Sandfly-borne diseases	
Leishmaniasis	.
Sandfly fevers	.

	Context	Endemic disease	Pathogen	Vector
1		√	√	√
2		-	√	√
3		-	-	√
4		-	√	-
5		-	-	-

Why?



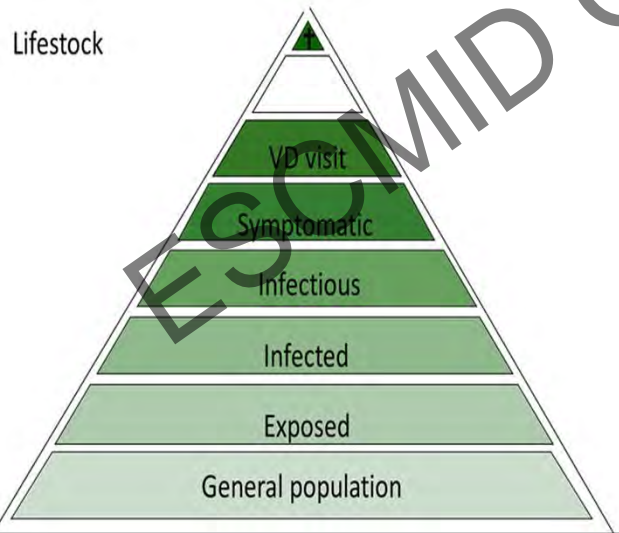
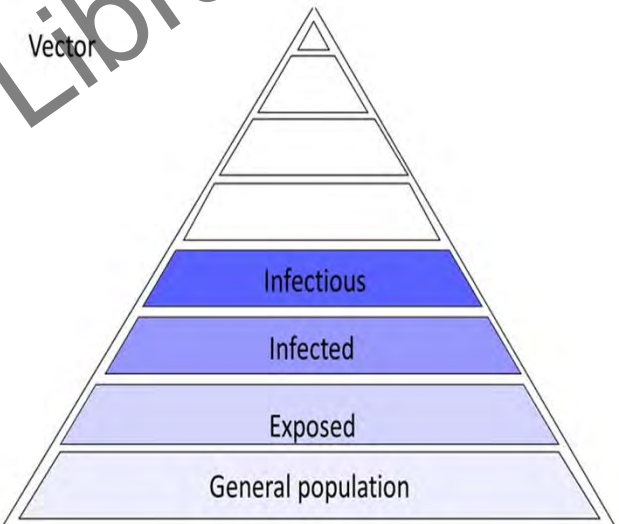
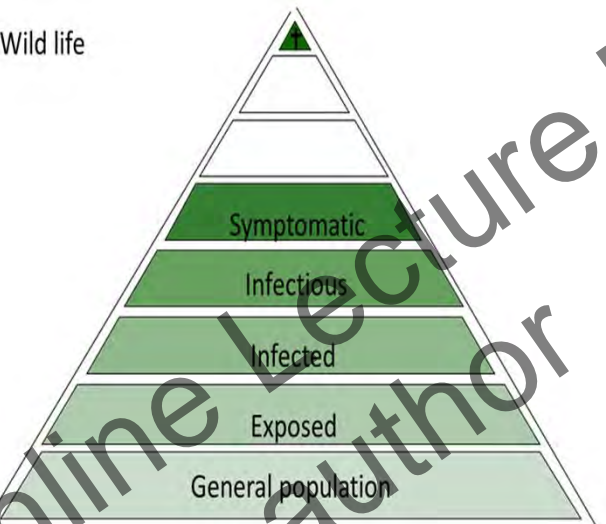
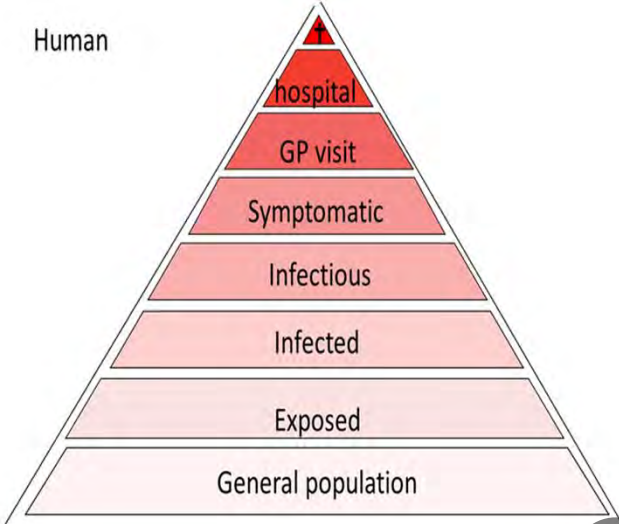
Different types of VBD context

based on the current presence (✓) or absence (-) of disease (endemic human cases), pathogen or vector

Context	Endemic disease	Pathogen	Vector	Examples of diseases holding for the Netherlands	
					Disease burden
2	-	✓	✓	Dirofilariasis	
3	-	-	✓	West Nile Fever	
4	-	✓	-	Leishmaniasis/ dengue	Threat
5	-	-	-	Crimean Congo haemorrhagic fever	

* Endemic infections with human cases.

General surveillance pyramid assembly



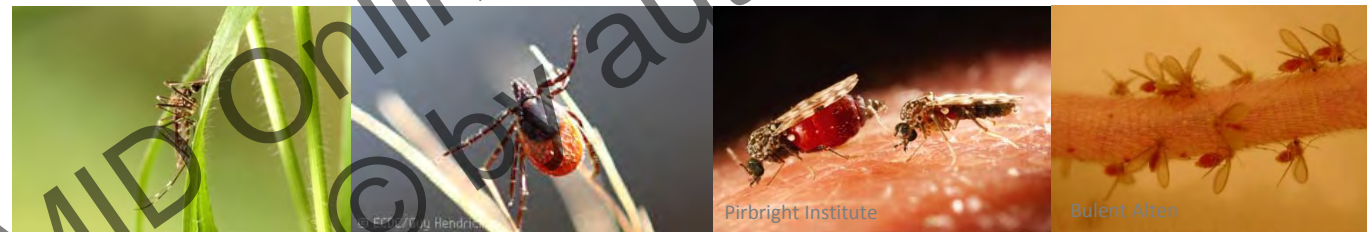
Context 3

Context 4 and 5

Context 1 and 2



VectorNet

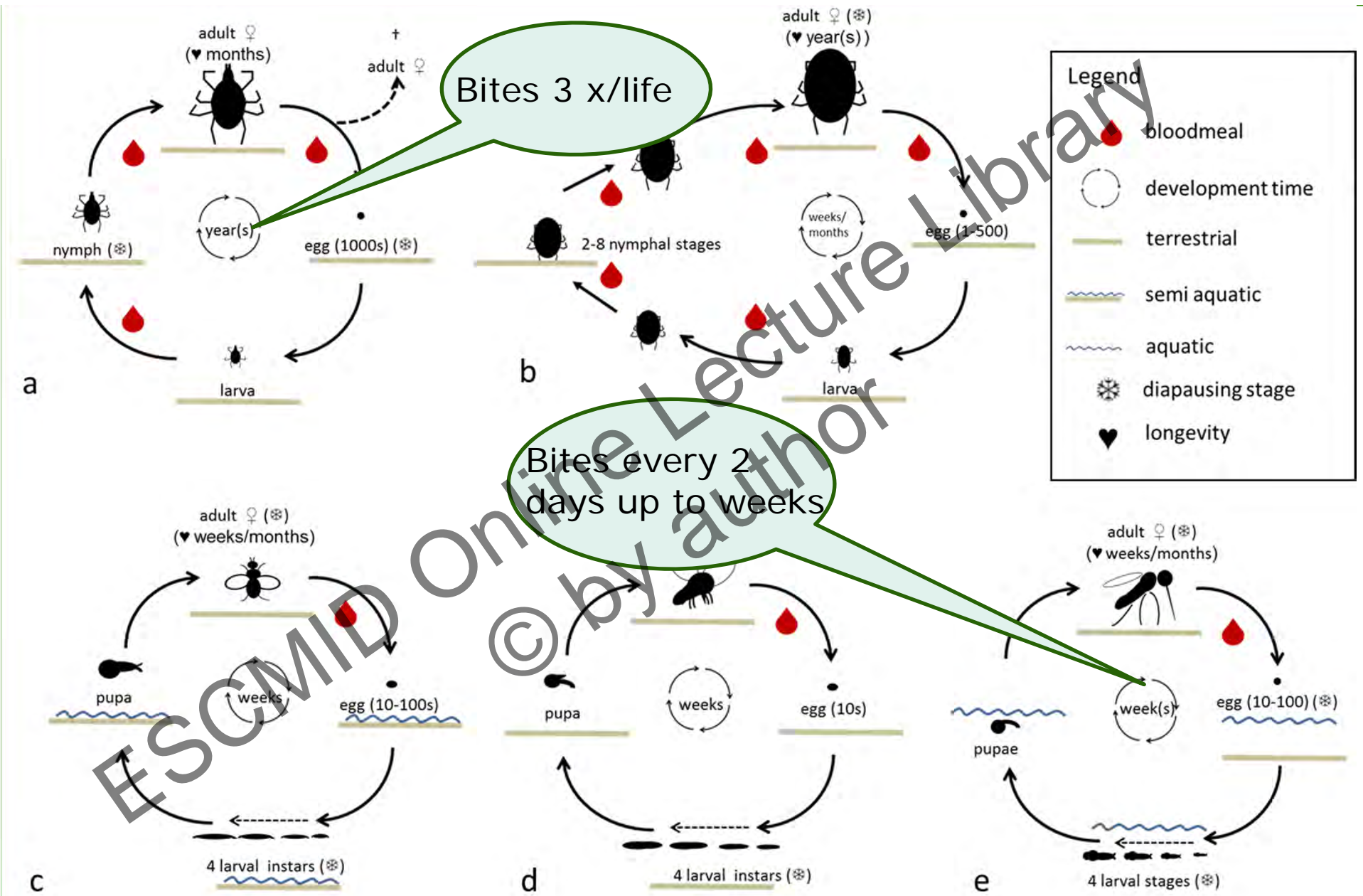


European Network for sharing data on geographic distribution of arthropod vectors transmitting human and animal disease agents



3. Virus surveillance in vectors

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Natural infection rates



Testing for pathogens in arthropod is done to

- identify species that are potential vectors: Entomological research
- investigate the epidemiology of the pathogen: Early Warning

NB: IR to realise the sufficient number of vector for detecting virus

- for example, *Chen et al. 2010* calculated that the sample size needed to detect a virus at infection rate of 0.50-12.59 per 1000 specimen (range of DENV in field) with a probability of 0.8 would require the collection and testing from **127-3219 females per site per time slot**

Dengue largely clustered. Only positive mosquitoes in houses with sick person

Mammen et al 2008 PlosMedicin

Natural infection rates



Testing for pathogens in arthropod done :

- To identify species that are potential vectors: Entomological research
- To investigate the epidemiology of the pathogen: Early Warning

When interpreting infection rates, issues need to be taken into account:

- Infection rate low -> large number of specimen collected -> testing in pools
✓ Minimal Infection Rate MIR or Maximum Likelihood Estimation MLE
- PCR detect genetic material \neq viable, infectious microorganisms
- Infection rate is not a stable parameter of vector-pathogen combination
- Denominator important (which are area, which period)

WNV and USUV (Northern Italy)

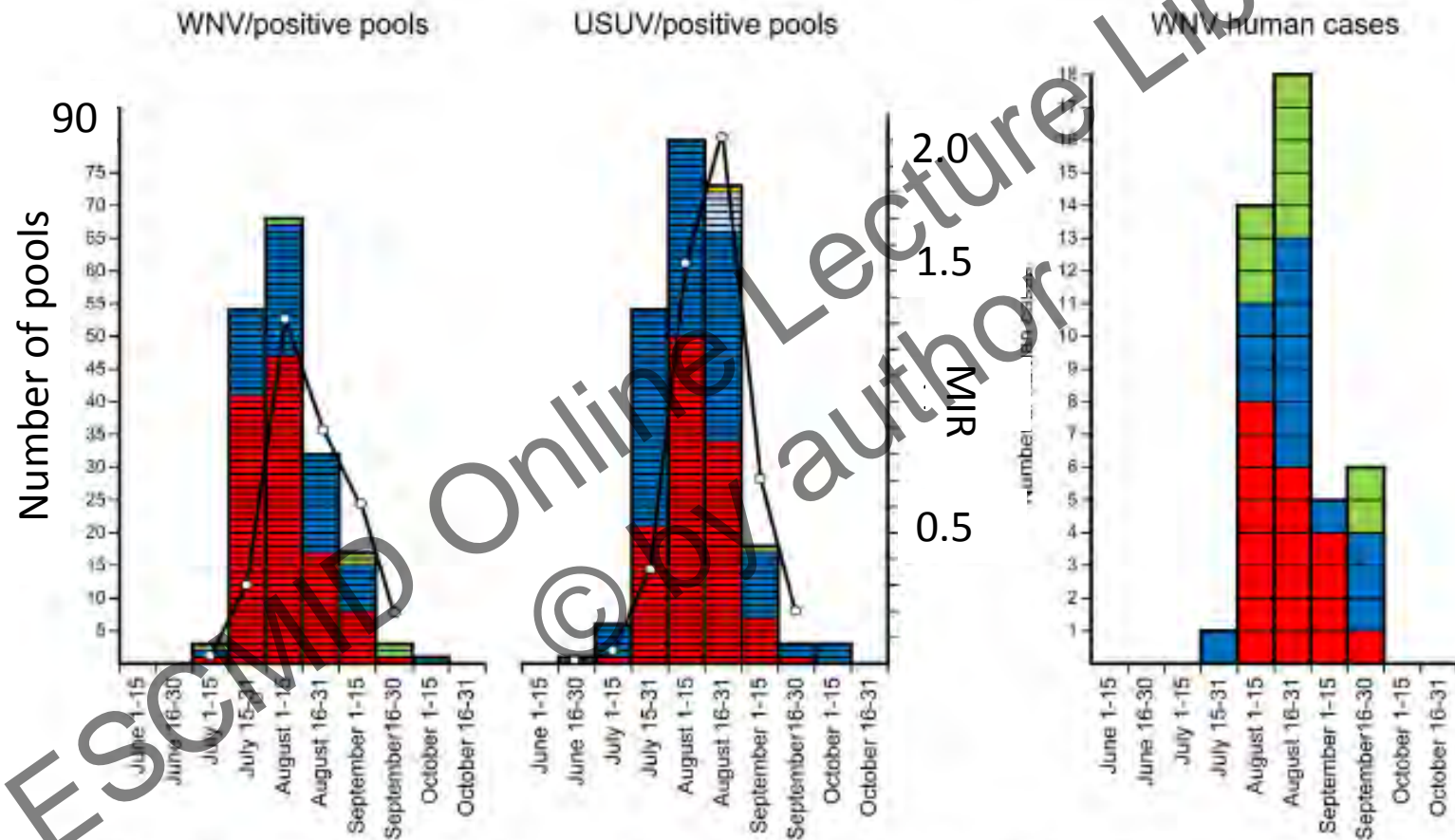
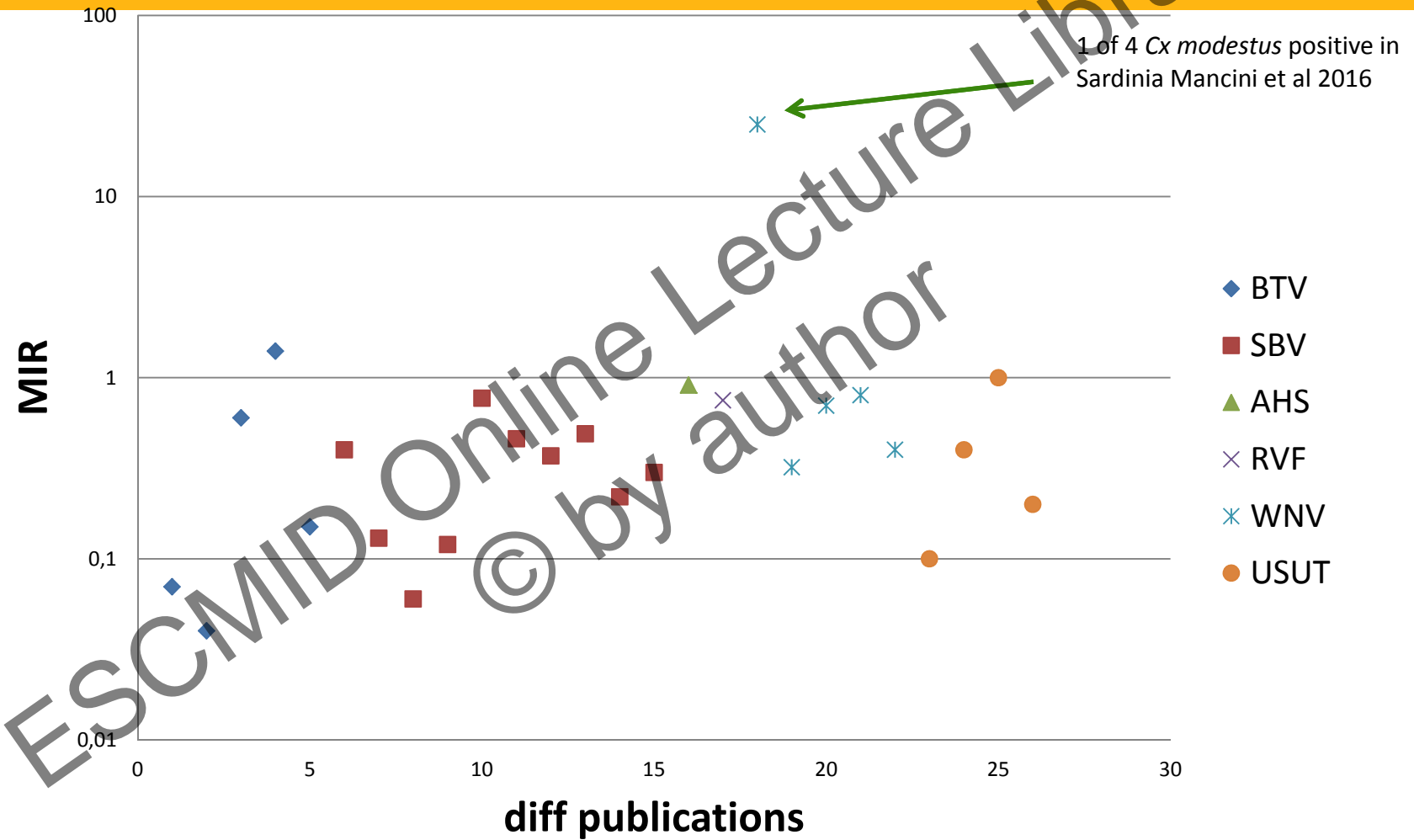


Fig 2. WNV- and USUV-positive pools and human cases of West Nile neuroinvasive disease (WNNND). Mosquito pools tested positive for WNV, USUV, and WNNND cases, with reference to the sampling period and region (Emilia-Romagna, red; Lombardia, green; Piemonte, yellow; Veneto, blue; and Friuli Venezia-Giulia, azure; black line represent the mosquito minimum infection rate).

doi:10.1371/journal.pone.0140915.g002

Infection Rate (%)



Infection rate (%)



- (M)IR in culicoides < mosquitoes < sandflies < ticks

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4. Take home messages

Vector borne disease surveillance

- is multidisciplinary
- needs to be tailored to each disease
- may largely differ between diseases
- needs to be implemented in context

– **May largely differ between countries and diseases**



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Thanks

Questions?

