

Introduction to Veterinary Epidemiology and Animal Disease Risk Analysis

Sun Xiangdong (Ph.D)

China Animal Health and Epidemiology Centre

21/09/2007

The views expressed in this paper/presentation are the views of the author and do not necessarily reflect the views or policies of the Asian Development Bank (ADB), or its Board of Governors, or the governments they represent. ADB does not guarantee the accuracy of the data included in this paper and accepts no responsibility for any consequence of their use. Terminology used may not necessarily be consistent with ADB official terms.

What is Epidemiology?

Definition of Epidemiology

The study of patterns and determinants of disease in a population in order to identify prevention and control strategies

Main Principal of Epidemiology:

*Disease does not occur
randomly in populations!*

Epidemiology

- Population focused
- Includes a broad definition of disease
- Involves describing disease in relation to individual, place and time
- Involves an understanding of change, and the ability to evaluate whether chance played a role
- Provides tools for studies

Approach to Veterinary Epidemiology

- Look for patterns
- Describe
 - Population
 - Place
 - Time
- Make comparisons
- Establish cause(s)

Classifications of Veterinary Epidemiology

- Descriptive Epidemiology
 - Population, place, time
 - Surveys
 - Case reports and case studies
- Analytical Epidemiology
 - Quantitative
 - Hypothesis-testing
- Experimental Epidemiology
 - Clinical trials and modeling

Micro vs Macro Epidemiology

Micro-Epidemiology

- Farm or herd level
- Traditional investigative approach

Macro-Epidemiology

- Country or state level
- Usually government agencies

Causes of Disease

- An *exposure* that leads to a new case of a disease
 - Agent
 - Host
 - Environment

Agents of Disease

- Infectious
 - Virus, bacteria, fungi, prion
- Chemical
 - Toxins, allergens
- Physical
 - Radiation, impact

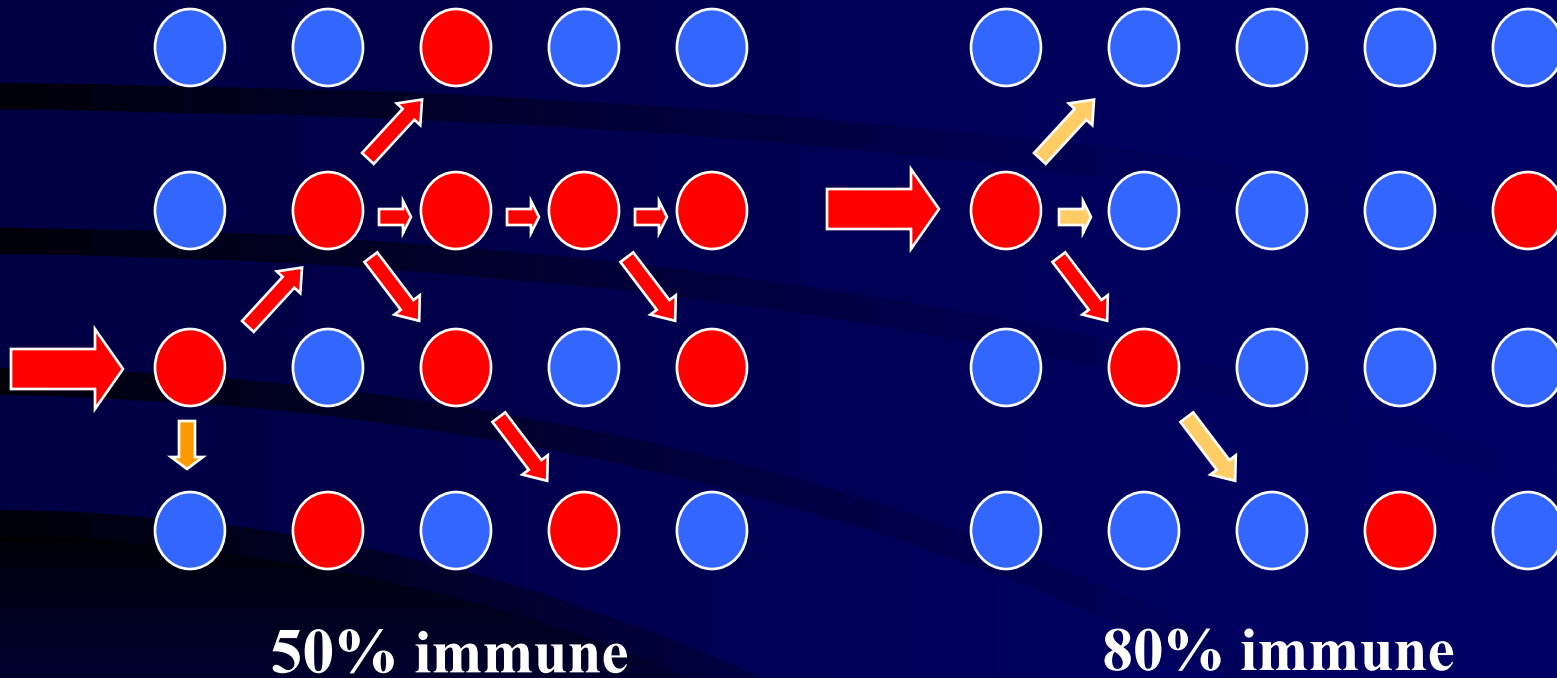
Factors that Affect Infectious Agents of Disease

- Infectivity
- Pathogenicity
- Virulence
- Host Range
- Lifecycle
- Reservoir
- Genetic Stability
- Vector

Host Factors that can be Associated with Disease

- Genetics
- Age
- Species
- Immune function
- Herd Immunity
- Use
- Diet
- Gender

Population Immunity



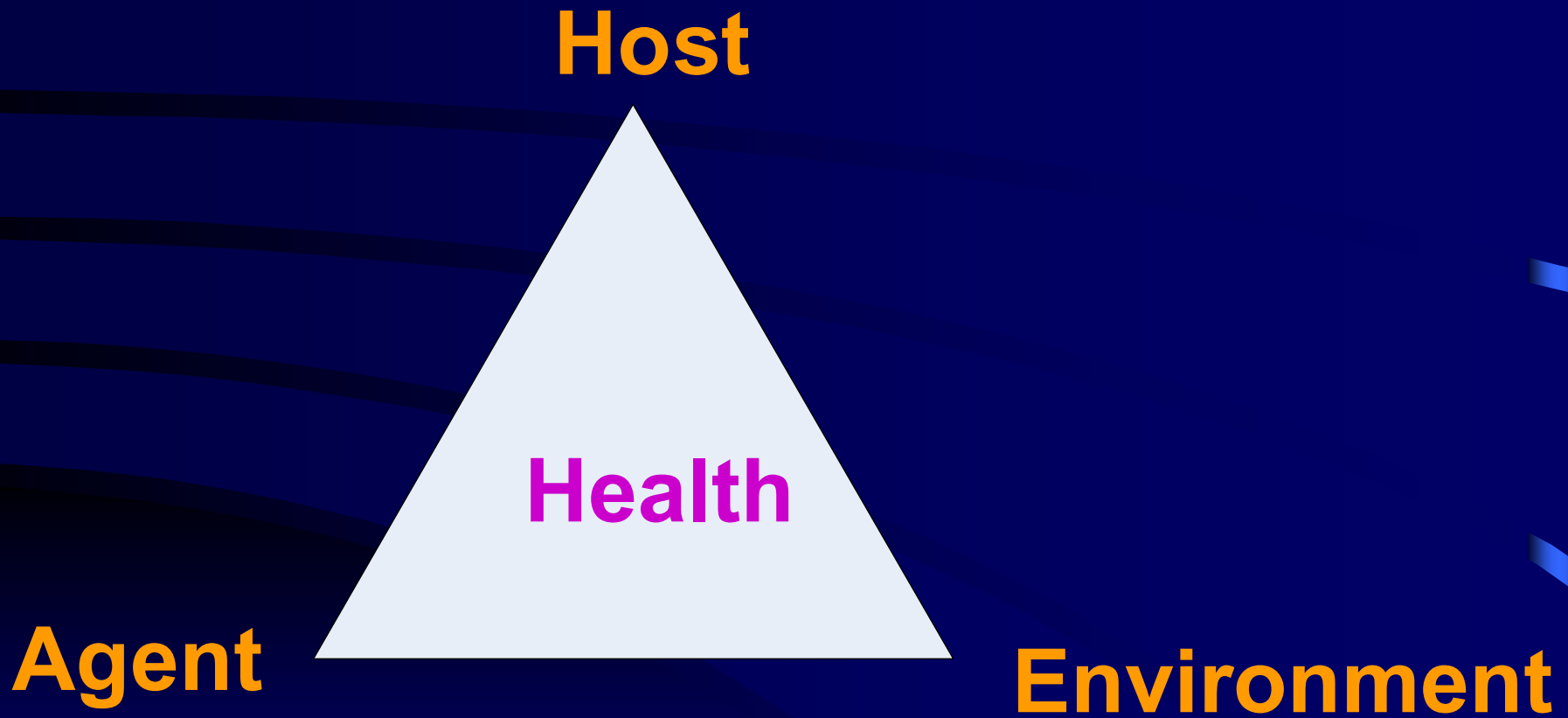
 **Infectious agent**

 **susceptible**  **immune**

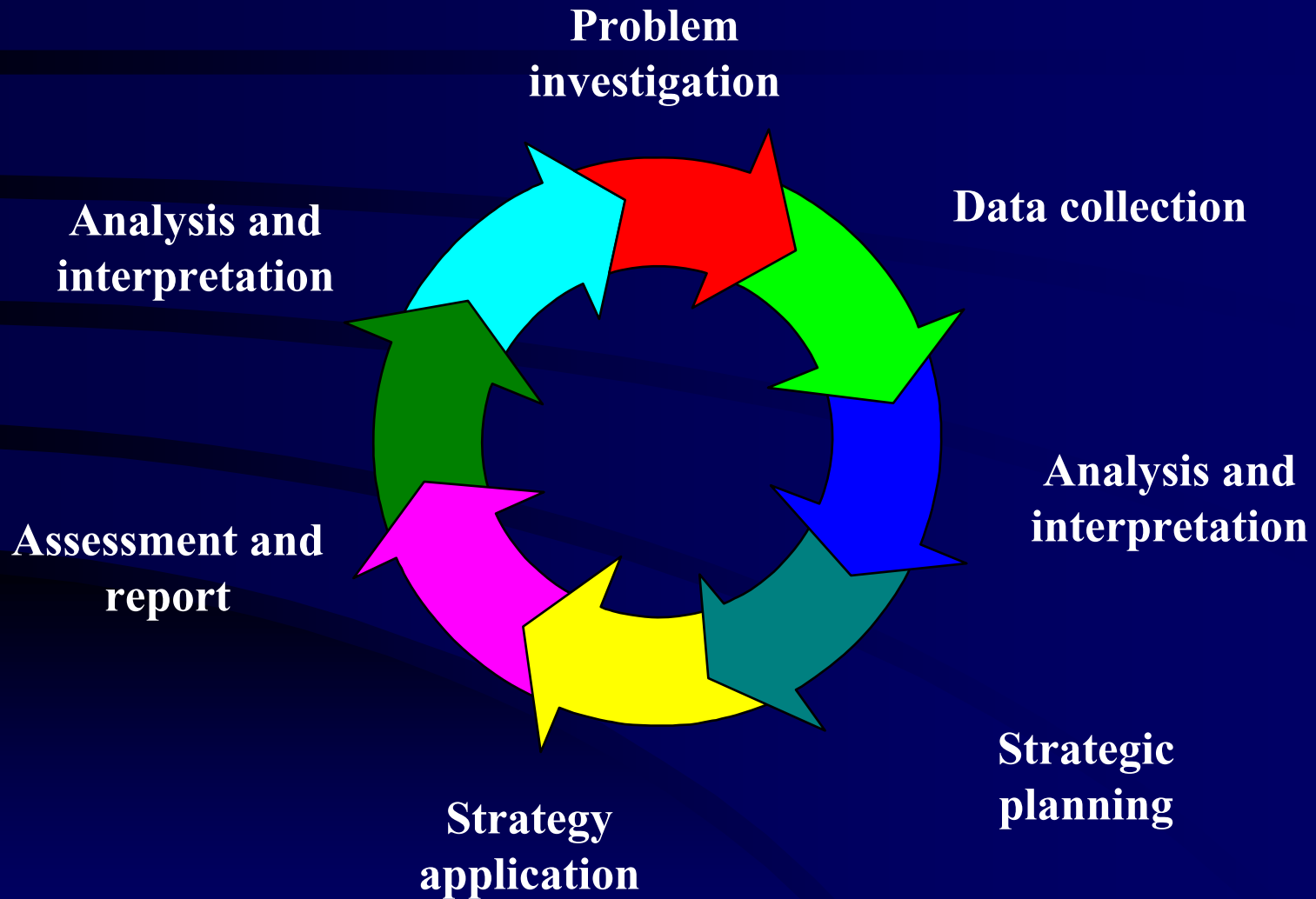
Environmental Factors that can be Associated with Disease

- Climate
- Geography
- Housing
- Other plants and animals
- Stressors such as noise, light, pollution
- Feed
- Use of the animals

Determinants of Disease



Epidemiologic Investigation



Veterinary Epidemiologist Characteristics

- Inquisitive, curious, able to identify potential problems
- Have investigation skills
- Open minded
- Creative
- Interest in working with the public
- Ability to use qualitative as well as quantitative data to approach and solve problems

Veterinary Epidemiology

- Veterinary epidemiologists need to ask:
 - Who?
 - Where?
 - When?
 - What?
- To determine:
 - *Why/How?*

Uses of Veterinary Epidemiology

- Respond to outbreaks
- Prevent disease
- Decrease impacts of disease
- Provide science for policy formation
 - Health
 - Food Safety
 - Security
 - Trade
 - Environment

Veterinary Epidemiology

- Veterinary epidemiologists have the ability to impact many different areas
- The skills needed are diverse
- All veterinarians are epidemiologists on some level

Can we avoid the introduction
of diseases?

Risk, Trust and Trade

- Zero risk approach to trade
- If in doubt, keep it out...
- Effective in avoiding disease introductions

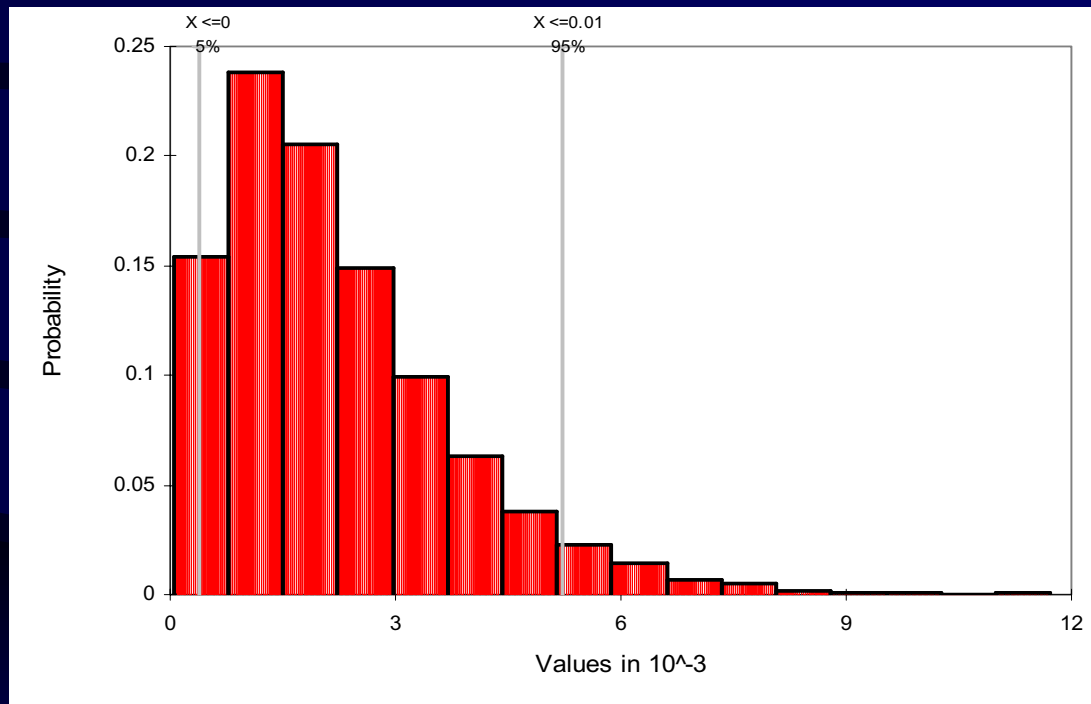
BUT OFTEN...

- Excessively stringent measures
- Barriers to trade
- Lack of scientific basis

Zero risk and trade

- Zero risk does not exist
- Trade implies risk
- Lack of trade also implies risk
 - Unregulated trade

Animal Health Risk Analysis



Cristóbal Zepeda. Centers for Epidemiology and Animal Health USDA-APHIS /Animal Health Population Institute, Colorado State University

Risk analysis

A process composed of:

- Hazard identification
- Risk assessment
- Risk management
- Risk communication



Definition

- Risk analysis:

Evaluation of the likelihood of entry, establishment and spread of a disease and the associated potential biological and economic consequences and its impact on public health

Characteristics

- Consistent
- Scientifically based
- Flexible
- Transparent

When to do a risk analysis?

- When importing a new product or species
- When importing from a new country or zone
- When the health status of a country or zone changes
- During the process of regionalization
- To promote the export of commodities

Three questions:

- What can go wrong?
- How likely is it?
- If it happens, what is the magnitude of the consequences?

Types of risk analysis

- Quantitative
- Qualitative

Quantitative studies

Advantages

- More profound
- Notion of the probability of occurrence of an adverse event
- Informed decision-making

Disadvantages

- Require time
- Require good quality data
- Not possible to apply in all circumstances

Qualitative studies

Advantages

- Faster
- Applicable to a broader scope of circumstances

Disadvantages

- Less profound
- Do not provide a numerical probability of occurrence of an adverse event
- Less precise decision-making

Hazard

 **Source for potential damage**

 **Cause of the adverse event**

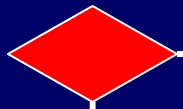
Risk

**Probability of occurrence of an
adverse event
and
the magnitude of consequences**

Hazard identification

- Identify pathogenic agents associated with the product
- Determine diseases present in the exporting country or zone
- Determine the validity of SPS measures
- Establish priorities

Is disease exotic to importing country?

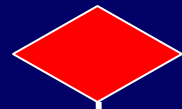


No

Yes

Requires scientific demonstration

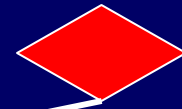
Is disease under official control?



No

Yes

Are same SPS measures required internally?

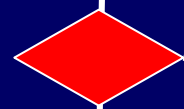


No

Yes

Are countries with equivalent health status treated equally?
(non discrimination)

Are SPS measures based on international standards (OIE Code) or on a scientifically valid risk assessment?

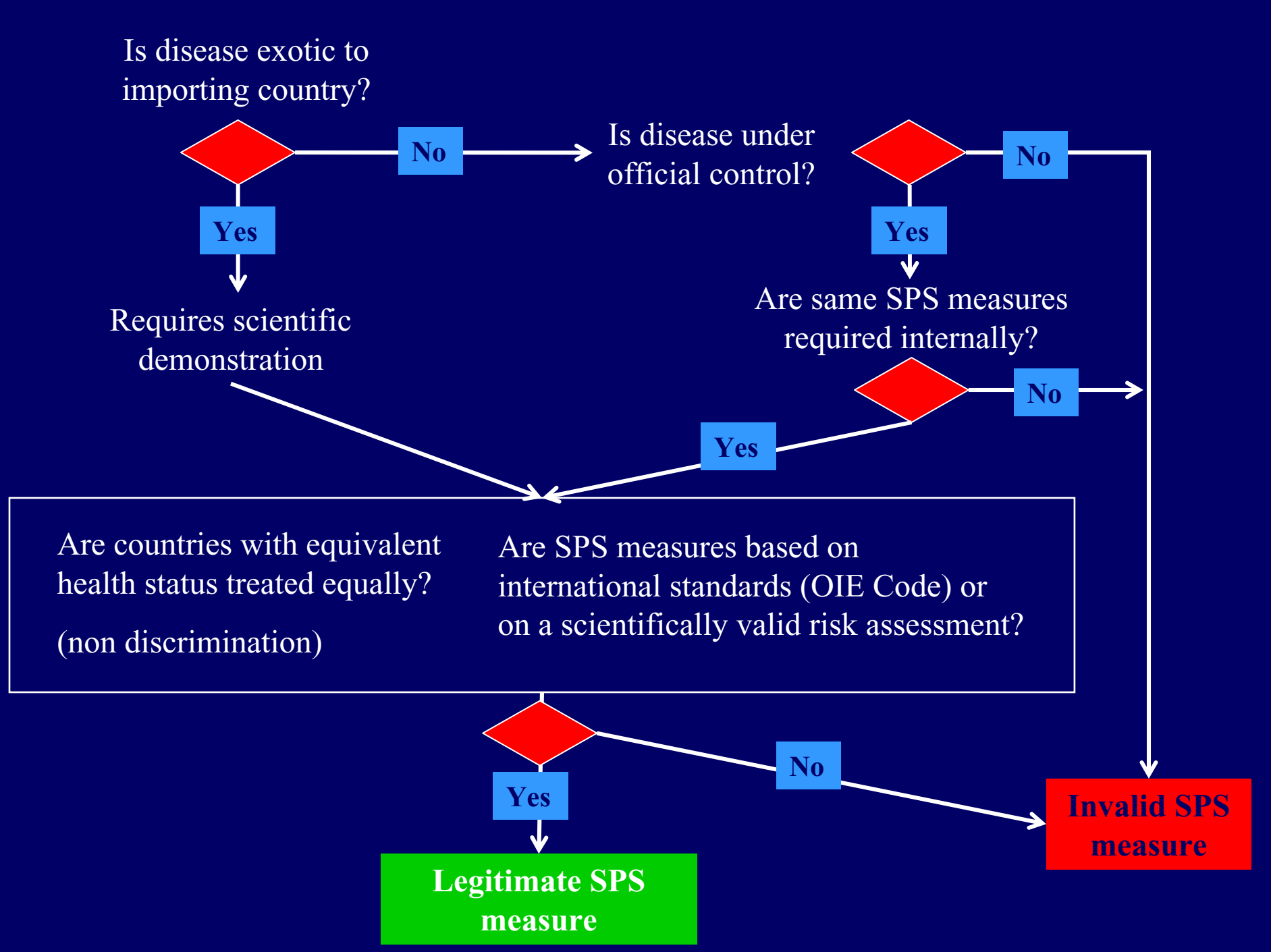


Yes

No

Legitimate SPS measure

Invalid SPS measure



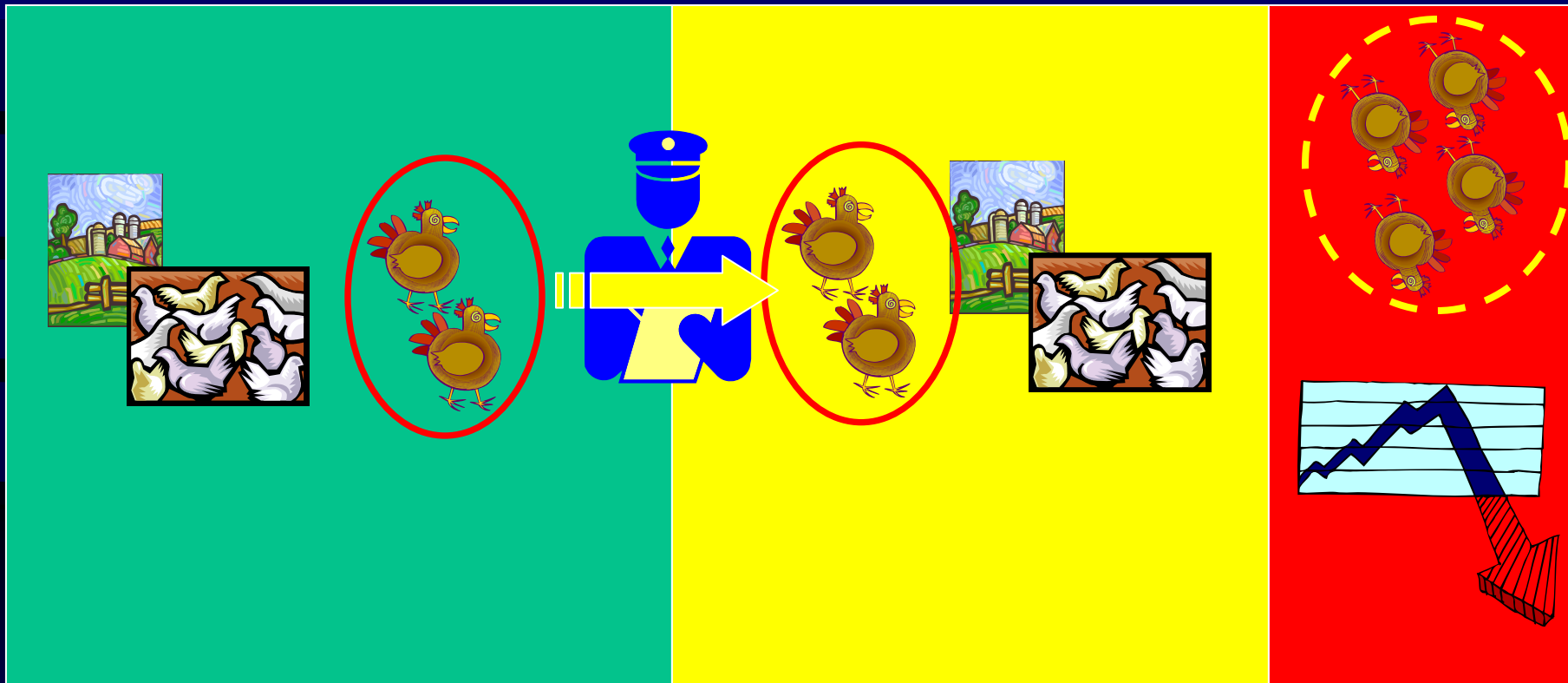
Risk assessment

- Release assessment
- Exposure assessment
- Consequence assessment
- Risk estimation

Release assessment

Exposure assessment

Consequence assessment



Exporting country

Importing country

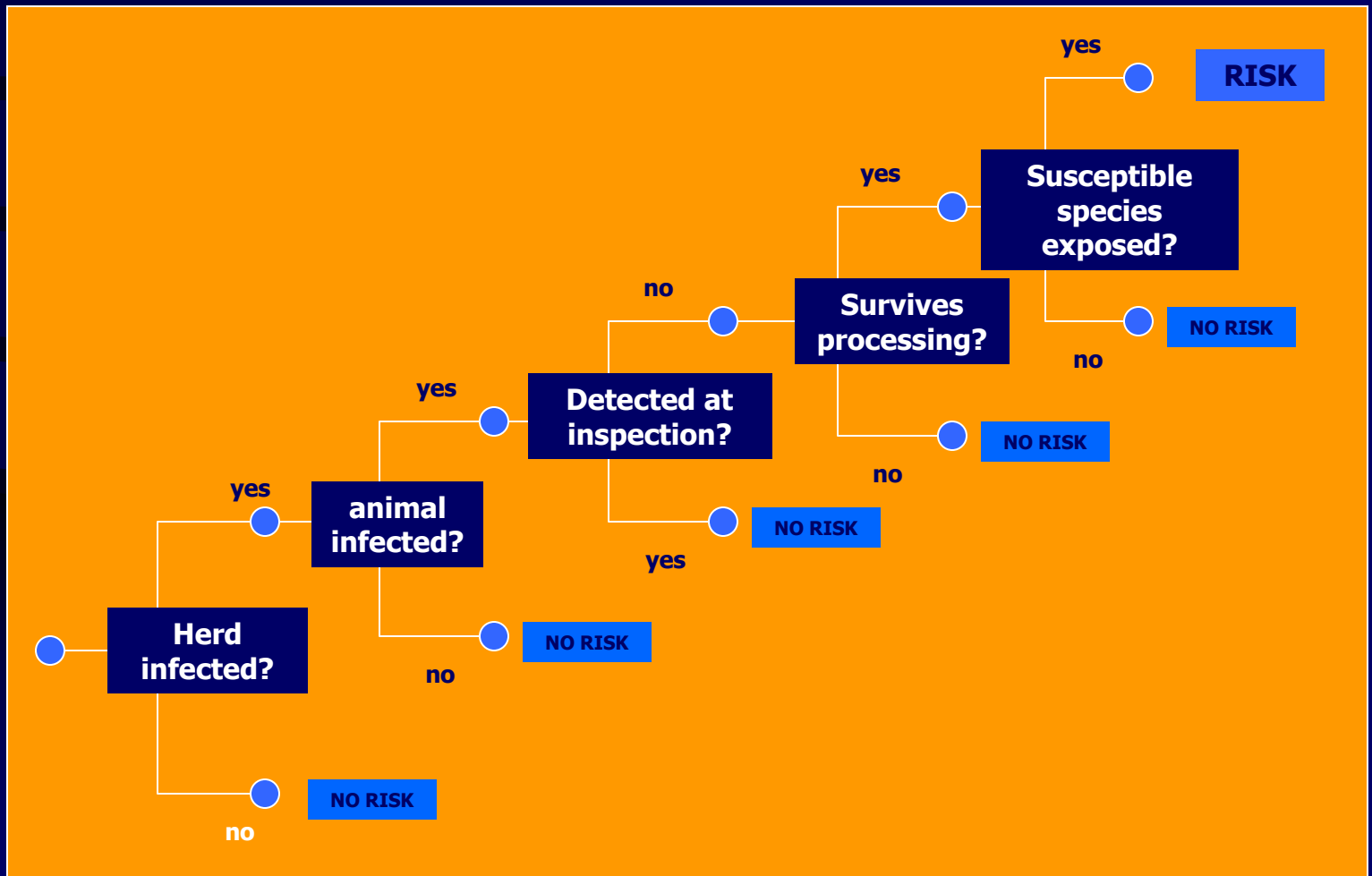
Release assessment

- Describes possible pathways for the introduction of a disease agent
 - Biological factors
 - Country factors
 - Commodity factors

Exposure assessment

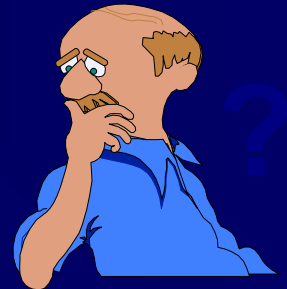
- Describes the pathways leading to an outbreak
 - Volume and use of the commodity
 - Density and distribution of susceptible animal populations
 - Immunity
 - Vectors
 - Seasonality

Scenario trees

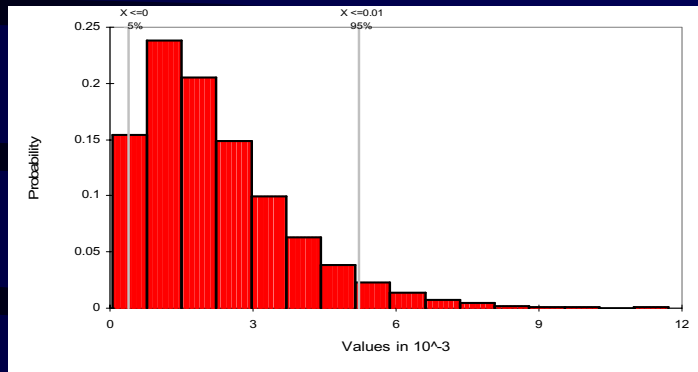


Uncertainty

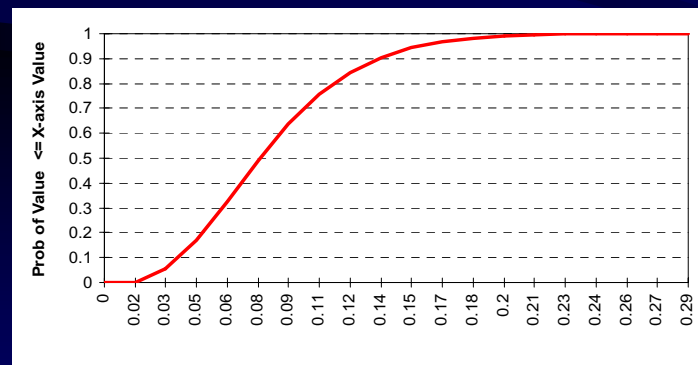
- There are no exact values for each parameter
- It is necessary to produce an estimate that incorporates uncertainty and variability
- Use of simulation programs



Results



- Not a point estimate but a range of probabilities



- The result reflects variability and uncertainty

Consequence assessment

- Direct consequences
 - Production losses caused by disease or death of animals
 - Public health consequences

Consequence assessment

- Indirect consequences
 - Cost of control and eradication
 - Compensation
 - Trade losses (domestic and international)
 - Environmental consequences

Risk estimation

- Integration of the results from:
 - Release assessment
 - Exposure assessment
 - Consequence assessment

		Exposure probability						
		Insignifi- cant	Extre- mely low	Very low	Low	Slight	Moderate	High
Release probability	High	I	EL	VL	L	S	M	H
	Moderate	I	EL	VL	L	S	M	M
	Slight	I	I	EL	VL	L	S	S
	Low	I	I	I	EL	VL	L	L
	Very low	I	I	I	I	EL	VL	VL
	Extremely low	I	I	I	I	I	EL	EL
	Insignificant	I	I	I	I	I	I	I

		Consequences					
		Insignifi- cant	Very low	Low	Moderate	High	Extreme
Release and exposure probability	High	I	VL	L	M	H	E
	Moderate	I	VL	L	M	A	E
	Slight	I	VL	L	M	A	E
	Low	I	I	VL	L	M	A
	Very low	I	I	I	VL	L	M
	Extremely low	I	I	I	I	VL	L
	Insignificant	I	I	I	I	I	VL



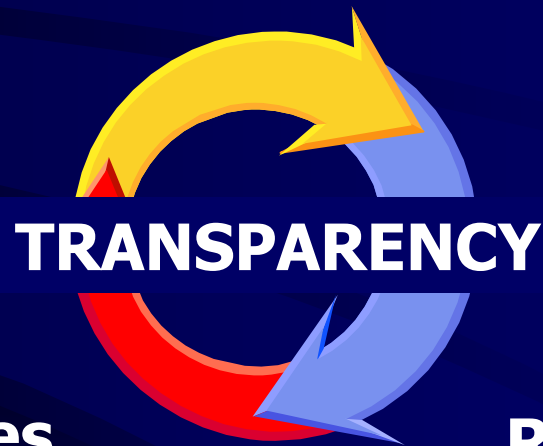
Risk management

- Risk evaluation
 - Determination of the appropriate level of protection
- Option evaluation
- Implementation
- Monitoring and review

Risk communication

Official Sector

Decision making body



Beneficiaries

importers, consumers,
producers

Risk recipients

producers, general public

Risk Information Exchanges on HPAI Epidemic Situation in China

Risk Information Exchanges on HPAI Epidemic Situation

- The National HPAI Prevention and Control Headquarter
- The epidemic prevention and control system of the Ministry of Agriculture

The National HPAI Prevention and Control Headquarter

- Commander

The vice premier of the State Council -- Hui Liangyu

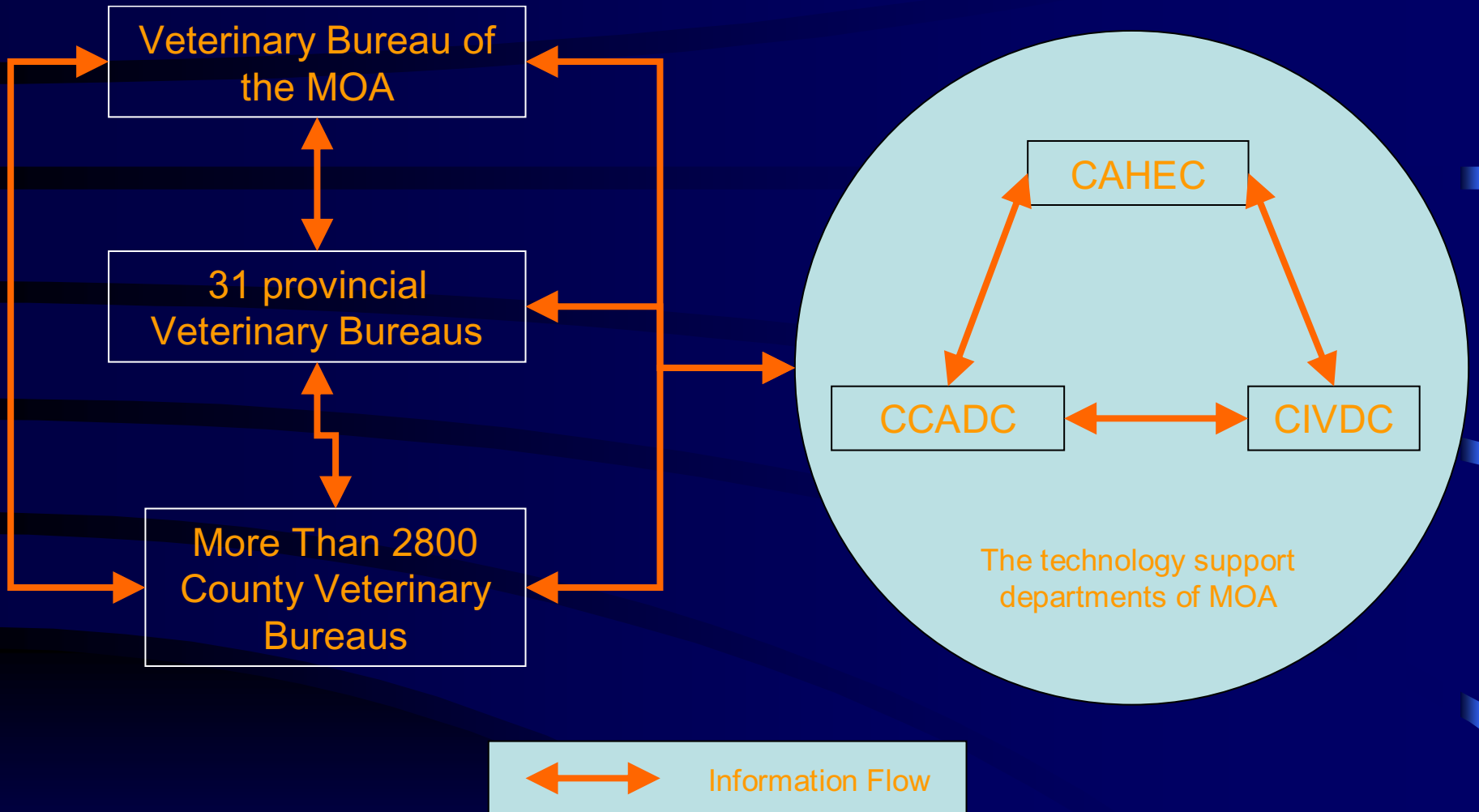
- Members

The ministers

The epidemic prevention and control system of MOA (1)

- Three technology support departments
 - ✓ China Animal Health and Epidemiology Center (CAHEC)
 - ✓ China Center for Animal Disease Control (CCADC)
 - ✓ China Institute of Veterinary Drug Control (CIVDC)





The epidemic prevention and control system of the Ministry of Agriculture

The epidemic prevention and control system of MOA (2)



- Local Surveillance and Report stations
31 provincial bureaus, 304 county stations, 146 border stations

Information Exchange between the Central Government and The Stakeholders

Interpretation of AI prevention and control knowledge and policies

- television, broadcast, newspaper and internet
- 0.6 million posters, 0.2 million potable books and 7 million clearness papers



Interpretation of AI prevention and control knowledge and policies

- 98.6% farmers knew about AI
- 77.2% farmers know the symptoms of AI
- 90% farmers knew the risk of AI virus could transmit from poultry to human

System of epidemic situation report and verification

- Public was required to report AI disease occurrence or wild bird death
- Local veterinary administrative departments verify all reports

international communication and cooperation

Distributing AI prevention and control information

- Inform international organizations and countries
- Inform the public

Distributing AI prevention and control information

■ Each case is able to research online



中国动物卫生与
China Animal Health

首页 | 关于部门 | 用户中心 | 发布信息 | 贸易状况

相关资讯

高致病性禽流感 禽流感

“高致病性禽流感” 相关

最新疫情信息

- 越南又继以1省1市出现禽流感 (2007年05月28日)
- 英国确诊多人感染H5N1禽流感病毒 (2007年05月28日)
- 英国威尔士暴发H5N1禽流感疫情 (2007年05月28日)
- 巴基斯坦再次发生禽流感疫情 (2007年05月24日)
- 尼日利亚再次发生禽流感疫情 (2007年05月24日)
- 越南禽流感疫情省市增至6个 (2007年05月24日)
- 印尼一名女孩死于禽流感 (2007年05月24日)
- 越南一名男子感染禽流感 (2007年05月24日)
- 加市再次发生禽流感疫情 (2007年05月23日)
- 越南又有4省市暴发禽流感 (2007年05月23日)
- 加拿大销售1000多万支禽流感疫苗 (2007年05月18日)
- 越南可能再度大面积暴发禽流感疫情 (2007年05月18日)
- 越南禽流感疫情蔓延 (2007年05月14日)
- 印尼一名孕妇死于禽流感 (2007年05月14日)
- 加特首次发现H5N1禽流感病例 (2007年05月08日)
- 越南发生新的禽流感疫情 (2007年05月08日)
- 印尼又有一人死于禽流感 (2007年05月08日)
- 欧盟计划补贴禽流感死损的禽类和蛋类生产 (2007年04月30日)
- 泰国投入90亿泰铢应对禽流感疫情 (2007年04月30日)
- 孟加拉国养殖业因禽流感损失惨重 (2007年04月30日)
- 卡塔尔举行禽流感应急演练 (2007年04月27日)
- 缅甸解除禽流感疫情禁令 (2007年04月27日)
- 科威特解除禽流感禁令 (2007年04月27日)



中国农业信息网
http://www.agri.gov.cn

中华人民共和国农业部
Ministry of Agriculture of the People's Republic of China

防控禽流感

农业部突发重大动物疫情应急指挥中心

首页 | 工作动态 | 科普知识 | 疫情发布 | 媒体报道 | 图片新闻 | 政策法规 | 国际动态

您的位置: 中国农业信息网 > 防控禽流感 > 疫情发布

标题	发布时间
湖南采取措施控制禽流感疫情扩散 已封锁疫区	2007年05月21日 08: 42
湖南省益阳市桃江县发生一起高致病性禽流感疫情	2007年05月21日 08: 16
甘肃省榆中县发生亚洲H5N1型口蹄疫疫情	2007年05月18日 11: 19
拉萨市城关区活禽交易市场发生鸡只异常死亡 国家禽流感参考实验室分离到禽流感病毒	2007年03月07日 08: 15
福建省确诊一例人感染高致病性禽流感病例	2007年03月01日 08: 38
青海省德令县发生亚洲H5N1型口蹄疫疫情	2007年02月28日 17: 07
青海省大通县发生亚洲H5N1型口蹄疫疫情	2007年02月19日 08: 56
甘肃省景泰县发生亚洲H5N1型口蹄疫疫情	2007年02月02日 20: 29
新疆阿克苏地区新和县检测发现亚洲H5N1型口蹄疫病毒阳性牛	2007年01月30日 16: 50
甘肃省平川区发生亚洲H5N1型口蹄疫疫情	2007年01月19日 17: 17
重庆市万州区、甘肃省永登县发生亚洲H5N1型口蹄疫疫情	2006年11月18日 16: 33
宁夏银川市高致病性禽流感疫情已被扑灭 疫区封锁解除	2006年10月27日 19: 20
内蒙古包头市高致病性禽流感疫情已被扑灭 疫区封锁解除	2006年10月26日 17: 00
青海省大通县发生亚洲H5N1型口蹄疫疫情	2006年10月16日 16: 51
宁夏回族自治区银川市西夏区发生一起H5N1高致病性禽流感疫情	2006年10月06日 09: 30
内蒙古包头市九原区发生一起高致病性禽流感疫情	2006年09月30日 19: 31
西藏曲水县发生亚洲H5N1型口蹄疫疫情	2006年09月21日 08: 34
青海省循化县发生亚洲H5N1型口蹄疫疫情	2006年08月21日 16: 29
长江开罗第一类候鸟保护区检出H5N1禽流感病毒	2006年08月18日 09: 30

Promoting technology communicating

- Conferences
- Assistance projects
- Published H5N1 virus genome sequences



Domestic aid projects

- Aiding 10 west provinces of China

Conclusion

- Risk analysis reduces subjectivity and provides a documented process
- Allows a more informed decision making process

But:

- Requires training and good quality data

Thank you !