# African Swine Fever Epidemiology and Control

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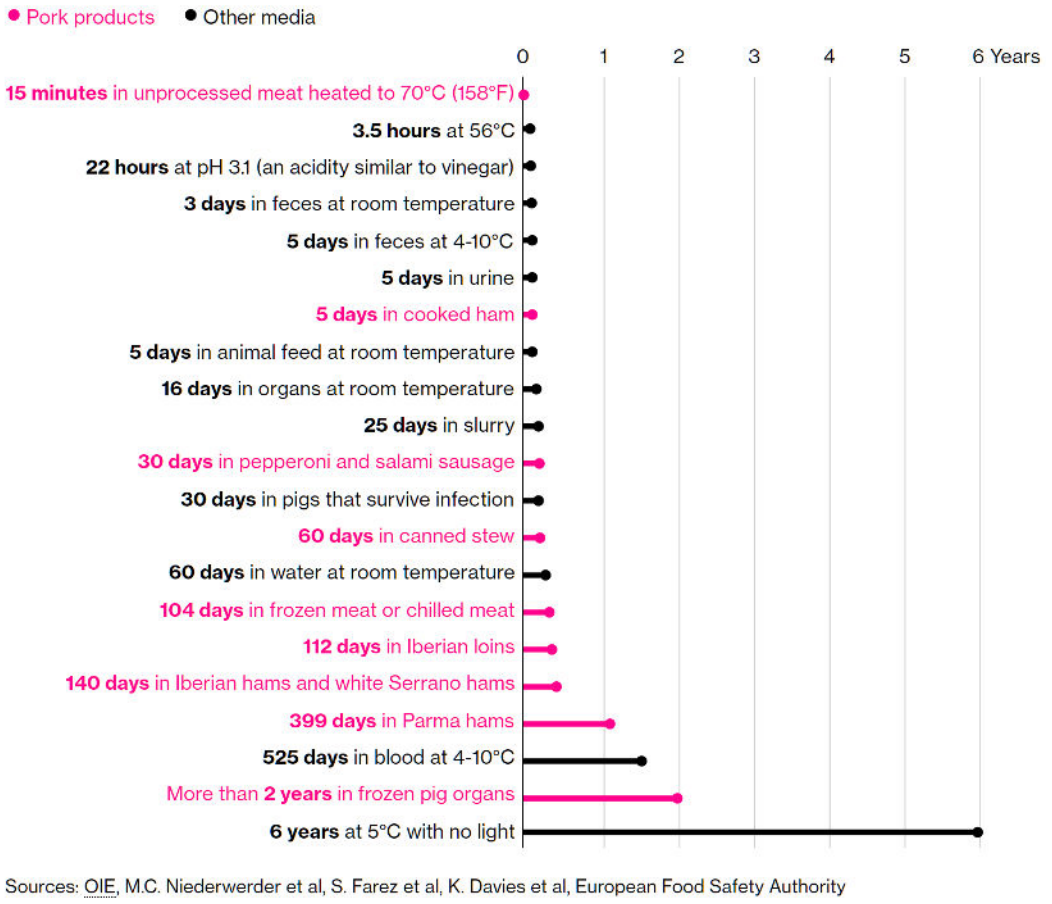
May 27, 2020

# African Swine Fever, a plague for pigs

## A hardy virus that can survive…




https://www.bloomberg.com/graphics/2019-eliminating-african-swine-fever/

## An easily transmissible disease:

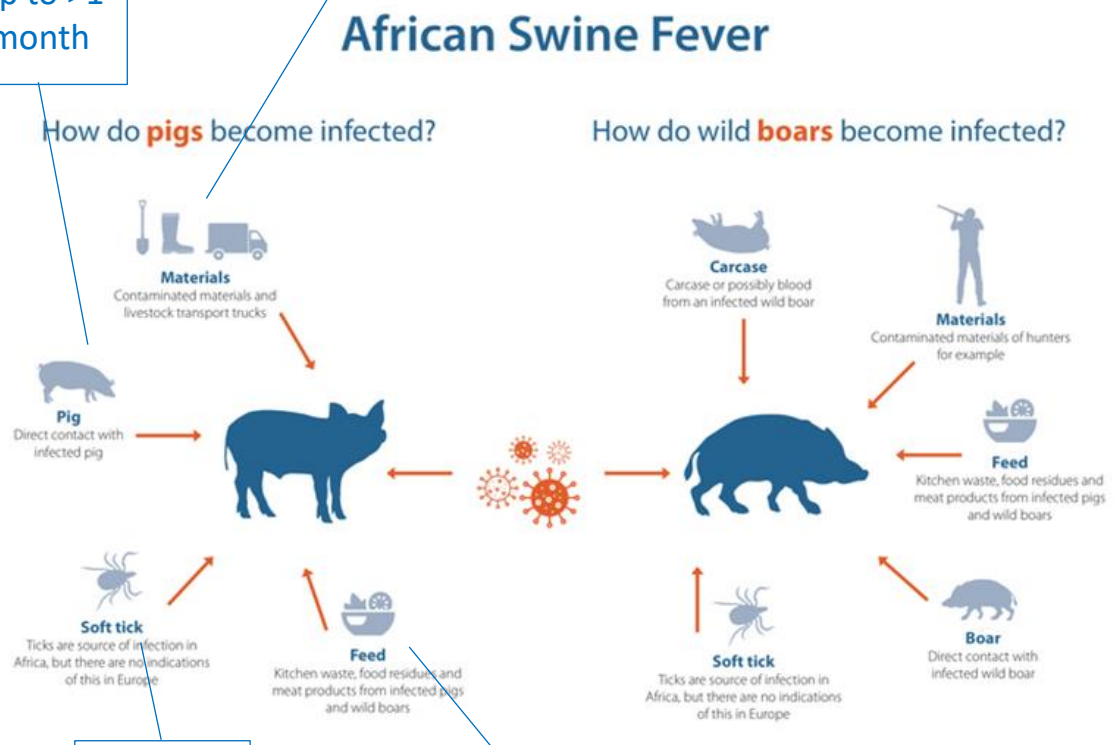
- Virus survival results in
  - Multiple transmission routes
  - Transmission over a prolonged period
- Little contaminated material can cause effective transmission
- Multiple hosts and vectors can be involved


https://porcinehealthmanagement.biomedcentral.com/articles/10.1186/s40813-018-0109-2

# Anthropogenic factors are key drivers of local and long-distance spread

Up to several weeks

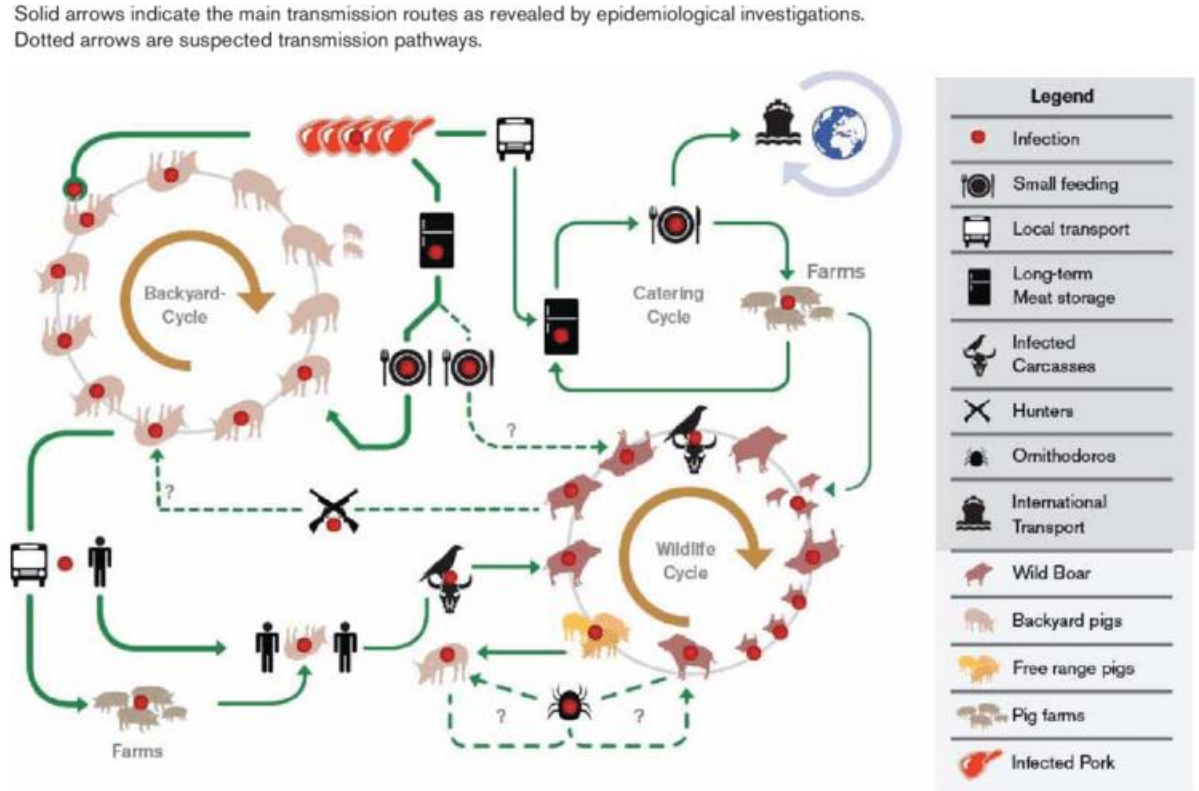
Up to >1 month




https://www.cidlines.com/en-US/problem-solver/pigs/african-swine-fever

For several years

Up to 1-2 years




http://www.fao.org/3/aq240e/aq240e.pdf

# A transboundary disease

- Originally discovered in Africa (1920s)
  - Sylvatic cycle, and spillover to pigs in Eastern and Southern Africa
- Expansion as global trade increased
  - Expanded to most of Sub-Saharan Africa, in many places without sylvatic hosts
  - Excursions in EU and Caribbean – late 50s to early 80s
  - Last 12 years:

    - 2007 Georgia, Caucasus, Russia. RF: endemic in domestic pigs and wild boars
    - 2012: Ukraine, 2013: Belarus.
    - 2014: Lithuania, Poland, Latvia, Estonia. ASF controlled in pigs, but endemic in wild boar
    - 2017-2019: Belgium, Bulgaria, Czech Republic, Hungary, Moldova and Romania, in wild boar
  - 2018: Introduction to Asia
    - 2018: China
    - 2019-2020: Mongolia, Vietnam, Cambodia, Hong Kong, North Korea, Lao, Myanmar, South Korea, Philippines, Timor-Leste, Papua New Guinea, Indonesia, India

# Dramatic impacts

- Direct losses
  - Large losses for the pig production sector: pig deaths (sick or culled), loss of jobs across the value chain (at pig farms but also up and downstream, often drop in consumption (consumer concerns), costs of restructuration of the production (higher biosecurity costs, etc.)
  - Also: costs of control measures and compensation, loss of international trade
- Can affect
  - other productions (lesser resources available for surveillance or support)
  - food security, tourism, etc.




# Clinical signs and diagnosis

Acute forms – expected in newly infected areas with highly virulent strains

- Sudden deaths (lethality >90% with high virulent strains)
- Fever, loss of appetite, dullness, tendency to huddle
- Erythema, cyanosis


- Post-mortem findings: hemorrhages, splenomegaly
  - See slides from Prof. Perez in Webinar #4 for more details
- Can be confused with other diseases: CSF, PRRS, PDNS, Erysipelas, Aujeszky's, bacterial septicemia (Salmonellosis)

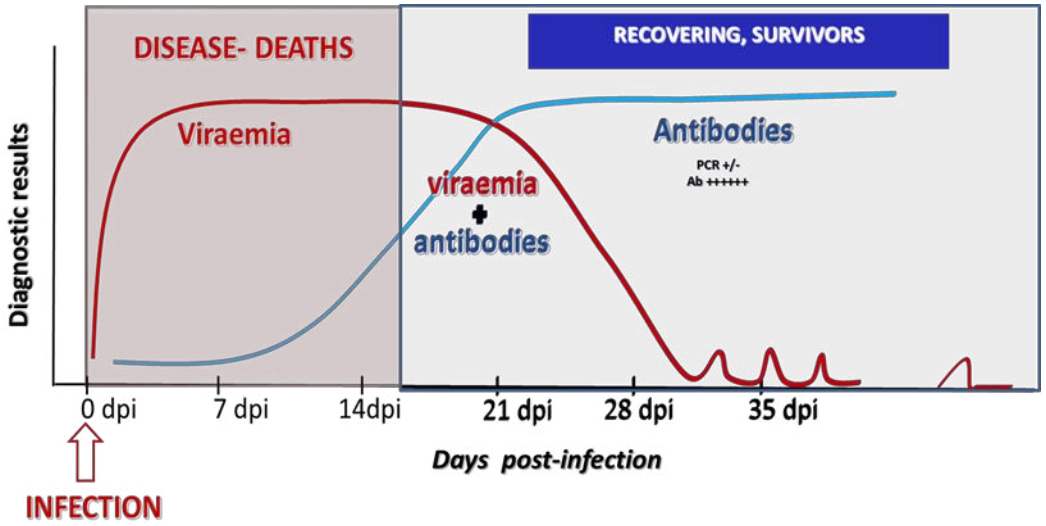
⇒Requires lab diagnostic for confirmation

http://www.fao.org/3/a-i7228e.pdf

# ASFV infection dynamics

In general,

- Symptoms: 4-19 days post infection (dpi)
- During the initial stage, virus replication but no immune response yet
  - ASFV genome detected in blood +/-2d before clinical signs
- Antibodies start +/- 7 dpi
  - Peak reached around 14-21dpi
  - Can persist in recovered/chronic cases for >2months




https://asf-referencelab.info/asf/en/procedures-diagnosis/diagnostic-procedures

# ASF diagnostic tests

## Virologic

### Target: ASFV genome or viral antigens

- Most commonly used: PCR (conventional and real-time)
- Ag detection (ELISA, pen-side tests): not commonly used, lower Se so use at herd level only
- More recently, development of isothermal assays: cheaper and easier to use in the field. Promising (higher Se than ELISA) but need more field evaluation
- Virus isolation and HAD tests used to confirm primary outbreak in new location

## Serological

### Target: Antibodies to ASFV

- Multiple ELISAs: limited Se, so use at herd level only, with confirmatory test
- Confirmatory tests: Immunofluorescence Antibody (IIF) and Indirect Immunoperoxidase (IPT) tests. High Se/Sp but require expensive equipment and well-trained staff.

Most recent review: Gallardo et al. (2019): https://doi.org/10.1016/j.virusres.2019.197676

# Limited options for control

- No vaccine or treatment
- Strict enforcement of sanitary measures
  - Early detection of infection: active surveillance and reporting
  - Remove virus at source of infection: culling and safe disposal, cleaning and disinfection
  - Prevent spread via economic, social and infrastructure network (infected animals, products, equipment): movement control
- Restructuration of the pig production
  - High biosecurity
  - Vertical integration
  - Traceability along value chain

# Limited options for control

- Multiple difficulties in implementing control program
  - Anthropogenic factors:
    - Lack of awareness of the disease: clinical signs, transmission mechanisms
    - Difficulty in early detection: unspecific early signs of infection, delays in diagnosis
    - Underreporting: lack of / inappropriate compensation, or lack of trust of / coordination with authorities, or fear of losing reputation in community/with trading partners, etc.
  - Sylvatic hosts:
    - Ticks: Iberian peninsula, southern Africa, Madagascar
    - Wild boar: RF, Europe, Asia
- But there are success stories
  - Iberian Peninsula successfully eradicated the disease
    - Most of territory: 2-5 years
    - Areas with low biosecurity farms and sylvatic hosts (wild boar and soft tick): +/- 30 years

# Preparing for & responding to ASF outbreaks

See http://www.fao.org/3/a-i1196e.pdf and OIE Terrestrial Animal Health Code

Importance of preparedness and contingency plans

- Preparedness plans: what government need to do before any outbreak
  - E.g. risk assessments and epidemiological studies to inform mitigation measures and targeted surveillance
  - Also includes preparing contingency plan, and recovery plan
- Contingency plans: what to do in case of disease incursion
  - Emergency response
  - Operations manual / SOPs for field staff
- Regular review and update of ASF plans

# Preparedness

- Building awareness among all relevant stakeholders
  - Disease: symptoms, mechanisms of transmission
  - Prevention – biosecurity and risky practices
- Emergency planning: Establish ASF contingency plan and SOPs
  - Incl. organizational arrangements, financing (compensation is key)
  - Diagnostic capacity
- At national and/or regional level:
  - Prevention of entry – risk assessment and targeted mitigation measures (inspections at border, import restrictions/quarantine, swill feeding ban, etc.)
  - Information on pig production & pork supply chain, wild boar distribution, distribution of farms vs country's ports of entry, etc.
  - Surveillance – clinical monitoring

# Emergency response

As soon as suspect case reported:

- Activate contingency plans
- Quarantine suspect farm
- Assess initial outbreak (incl. on-farm investigation)

Once outbreak confirmed:

- Implement control measures as quickly and completely as possible
  - Movement control, 3D
  - Importance of trust and collaboration with pig industry stakeholders
  - Initial assessment used to evaluate need to include other locations (via trace-forward and trace-back)
- Monitor progress and adjust policies if need be
  - Active surveillance in control zone and other at-risk areas
  - Careful lifting of measures after at least 40 days after last case in infected area(s)
- Continue information exchange with neighboring administrations
- Communicate with stakeholders – including OIE - and public

# On-farm investigation in case of suspect case

See http://www.fao.org/3/a-i7228e.pdf

SOPs should be in place, and kits for farm visits ready for use

- Collect data on suspected farms BEFORE visit
- Put suspected farm(s) on immediate quarantine
- Establish cleaning and disinfection at entry/exits, and implement good biosecurity practices during farm visits including PPE (details in FAO manual)
  - ASFV inactivated by 8/1000 sodium hydroxide (30 minutes), hypochlorites – 2.3% chlorine (30 minutes), 3/1000 formalin (30 minutes), 3% ortho-phenylphenol (30 minutes) and iodine compounds (OIE, 2013)
- Conduct clinical inspection and outbreak investigation
  - Notify 'at risk' farms (neighbors, contacts) of situation and have them enclose animals and monitor signs
- Collect samples & send to lab for confirmation
- Do not visit other farms

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