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eofmd
european commission for the
control of foot-and-mouth disease

State of foot-and-mouth disease research

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Global Foot-and-Mouth Disease
Research Alliance

FMD Research – historical breakthroughs

Our ability to control a disease is constrained by the tools available

FMD Research – historical breakthroughs

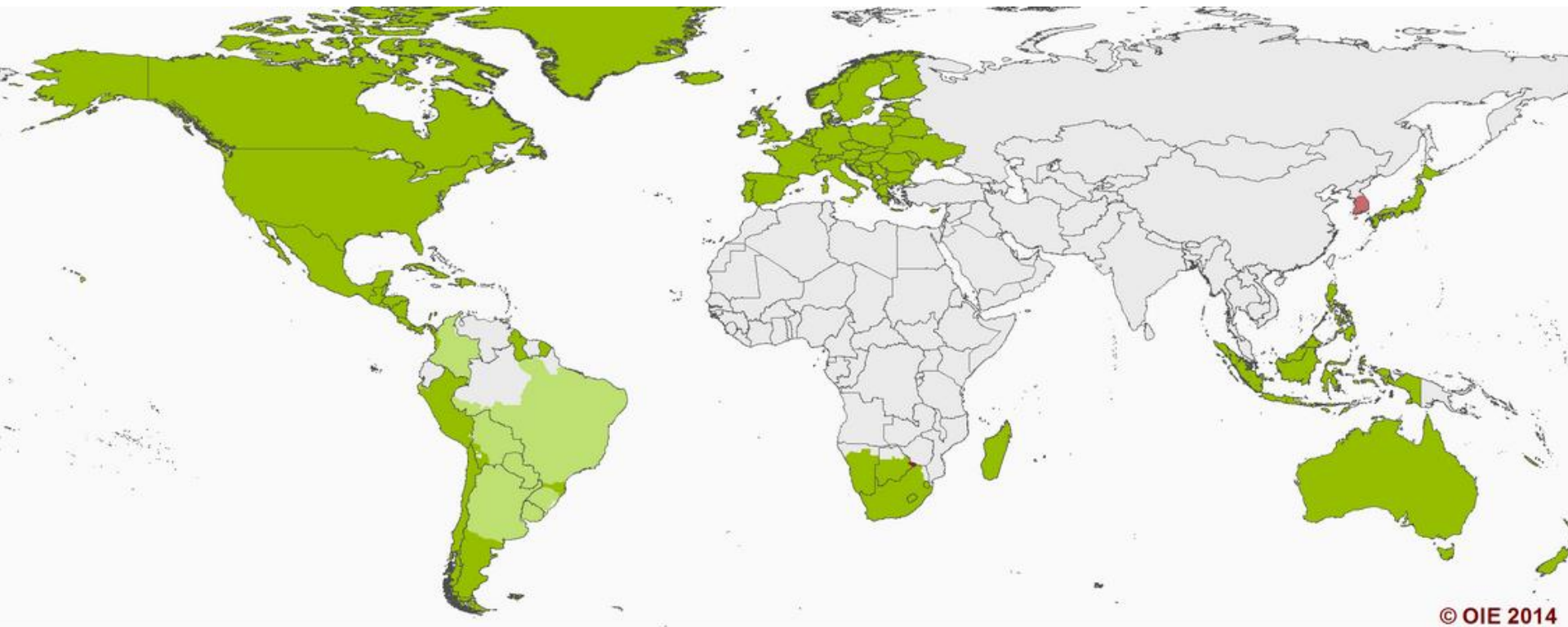
Our ability to control a disease is restrained by the tools available

**Disease
control**



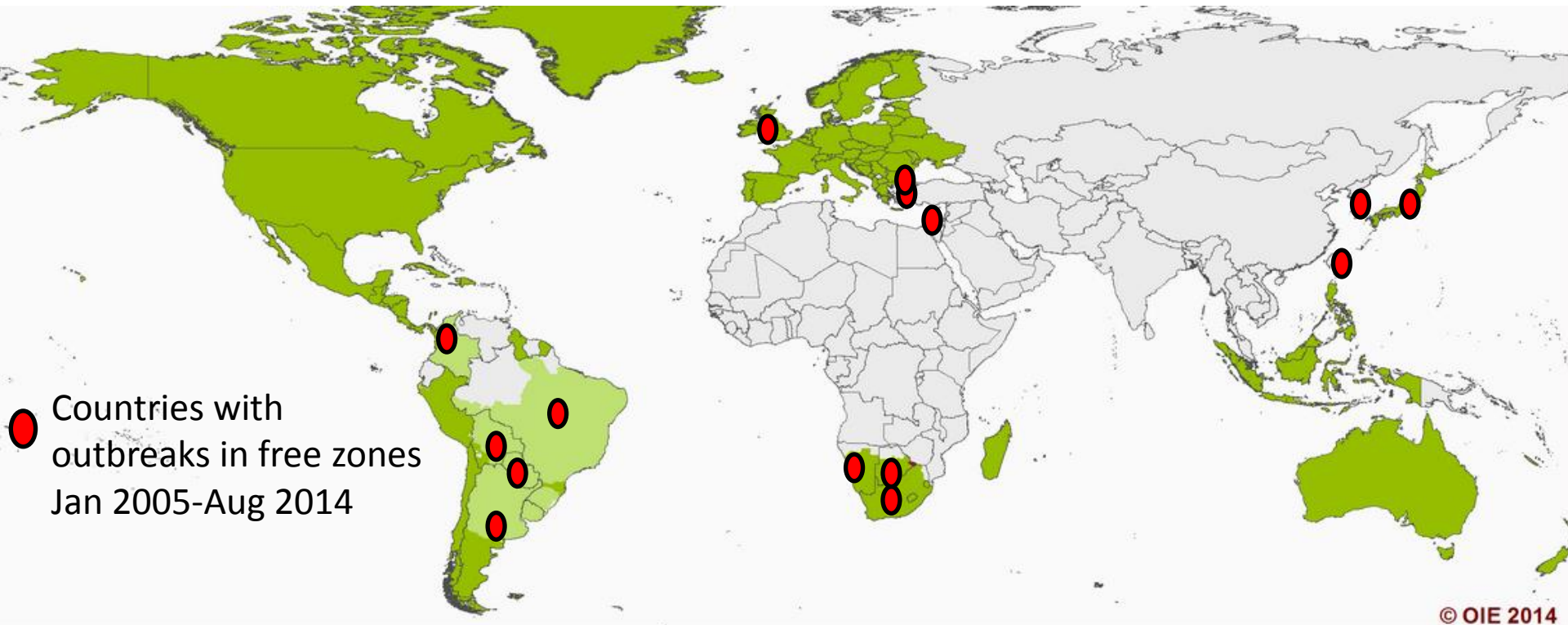
- **Control FMD where control not previously possible**
- **Same level of control but more efficient (time, cost)**
- **Increased certainty in disease/infection status (trade, rapid detection)**
- **Increased understanding**

Global control with current technologies



- Country/zone free without vaccination
- Country/zone free with vaccination
- Suspension of the status free without vaccination
- Suspension of the status free with vaccination
- No recognised status

Global control with current technologies



Countries with outbreaks in free zones
Jan 2005-Aug 2014

FMD research needs

- Free countries

- Preparedness, early detection and control

- Free and endemic with vaccination

- Vaccine immunity - duration, match
- Vaccine stability, safety, strategy & evaluation
- Proving freedom

- Limited control activities

- Impact estimation
- Feasibility of FMD control – effectiveness, cost, convenience/compliance

FMD research review - approach

- Literature review – FMD publications 2011-14
- Institute updates on current research
 - Contacted >50 FMD research institutes (GFRA/EuFMD)
 - Response from 33
 - Europe – 10 (30%)
 - North America – 5 (15%)
 - South America – 2 (6%)
 - Asia – 6 (3) (18%)
 - Africa – 8 (24%)
 - Australia/New Zealand – 2 (6%)
- Review by GFRA experts

Peer-reviewed publications June 2011-14

Research Category	Papers (n)
Epidemiology	116 (23%)
Vaccines	94 (19%)
Pathogenesis	74 (15%)
Molecular biology	57 (11%)
Diagnostics	55 (11%)
Immunology	50 (10%)
Policy, preparedness and trade	38 (8%)
Wildlife	19 (4%)
Vaccine evaluation <i>(quality, efficacy, effectiveness)</i>	16 (3%)
Other	15 (3%)
Economics	14 (3%)
Biotherapeutics	13 (3%)
Total	505 (100%)

Half modelling studies

Economic studies needed by those with least resources

Report: Key findings

Vaccines – The ideal FMD vaccine

- Effective, rapid and **long-lasting** protection with one inoculation
- Prevents viral transmission & carrier state
- Allow differentiation of infected from vaccinated animals (DIVA)
- Produced without the need for virulent FMDV
- Protection against multiple serotypes
- Stable antigen – long shelf life
- Reasonable cost to enable eradication programs

Gay et al. 2013

Vaccines

- Progress
 - Empty capsid vaccines
 - Adenovirus vector, Baculovirus expression system
 - Inactivated molecular chimeric vaccine
 - Early stages but:
 - Produced without live FMDV
 - Improved DIVA
 - Improved stability
- Gaps
 - Cost
 - Duration and breadth of immunity – important for endemic settings
 - African vaccine strains- SAT 2 vaccines
 - **Lack of standardised approach to novel vaccine evaluation**

Diagnostics

- Progress
 - Faster, cheaper, simpler diagnostics
 - RT-LAMP, high-speed, portable PCR, sequencing
 - Simple pen-side tests
 - More powerful molecular techniques
 - Next generation sequencing
 - Tools for molecular epidemiology
 - Better understanding of within-host virus evolution, between animal transmission, population level virus ecology
- Gaps
 - Continued progress in rapid/simple diagnostics & molecular techniques
 - Vaccine matching – beyond small scale, imprecise antibody assays
 - Wildlife diagnostics & sampling (under investigation)

Disease management

- Progress
 - Modelling approaches developed & widely used
 - Importance of field evaluation of control programmes
 - Alternatives to stamping out [vaccinate-to-live]
 - Incentivisation through commodity-based trade
- Gaps
 - Evaluation & validation of models
 - Practicalities of vaccinate-to-live
 - Safety & acceptance of commodity-based trade
 - **Strategies & guidance for endemic countries**
 - Knowledge sharing – South America

EuFMD – 3 Pillars: Research needs



1. Improve readiness for FMD crisis management by Members

- Vaccine matching tests & measures of cross-protective immunity
- Further development of modelling approaches for policy guidance
- Improved, cross-protective, DIVA vaccines

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- Cheaper vaccines with long lasting, broad spectrum immunity
- Capacity building – technical skills, regional collaboration, vaccine quality assurance
- Improved knowledge and monitoring of wildlife and illegal trade

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3. Promote the global FMD control strategy

- Cheaper vaccines with long lasting, broad spectrum immunity
- Can FMD be controlled with current vaccines without effective biosecurity?
- Economic impact of FMD & when are control efforts cost-effective
- Evaluation of commodity based trade as a safe way of exporting from wildlife FMD endemic areas

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- **Progress in genetic and molecular technologies is crucial & will benefit all**

Conclusion

“Cause for optimism, but much to be done”

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