

行政院及所屬各機關出國報告

(出國類別：國際會議)

**參加世界動物衛生組織第26屆東南亞及
中國大陸口蹄疫聯防計畫 (South East
Asia and China Foot and Mouth Disease
Campaign, SEACFMD) 及SEACFMD國
家協調員會議(National Coordinators
Meeting)**

出國人員姓名/服務機關/職稱

劉冠志/農業部動植物防疫檢疫署/技正

出國地區：馬來西亞吉隆坡

出國期間：112年8月22日至8月24日

報告日期：113年1月19日

行政院及所屬各機關出國報告提要

出國報告名稱：參加世界動物衛生組織第 26 屆東南亞及中國大陸口蹄疫聯防計畫及 SEACFMD 國家協調員會議

頁數： 27 含附件：無

出國計畫主辦機關/聯絡人/電話

農業部動植物防疫檢疫署/陸怡芬/02-3343-2052

出國人員姓名/單位/職稱/電話

劉冠志/農業部動植物防疫檢疫署動物防疫組/技正/02-2343-1425

出國類別：1.考察 2.進修 3.研究 4.實習 5.其他

出國期間：112 年 8 月 22 日至 8 月 24 日

出國地區：馬來西亞吉隆坡

報告日期：113 年 1 月 19 日

分類號/目：F7/農產品檢疫及動物衛生

關鍵詞：馬來西亞、口蹄疫

內容摘要：(200 至 300 字)

近年來亞洲各國發生豬隻傳染病疫情不斷，造成人類與動物生命財產受到威脅。對於近來發生口蹄疫及其他跨域動物疫情，各國除積極推動防疫政策來控制疾病擴散外，更發現防疫作為常與產業經濟效益與政府經費息息相關，使得防疫政策的擬定更加複雜。世界動物衛生組織（WOAH）為加強區域口蹄疫（FMD）控制，成立東南亞及中國大陸口蹄疫聯防計畫（SEACFMD），每年檢視該計畫推動狀況。本次第 26 屆 SEACFMD 次委員會會議及 SEACFMD 國家協調會議，即為汲取各國防疫、檢疫、診斷等經驗，並透過邀請歐洲專家、會議小組討論、經驗分享及意見溝通等方式，讓各與會成員國能有深度瞭解，並促成區域合作發展。

摘要

近年來亞洲各國發生豬隻傳染病疫情不斷，造成人類與動物生命財產受到威脅。對於近來發生口蹄疫及其他跨域動物疫情，各國除積極推動防疫政策來控制疾病擴散外，更發現防疫作為常與產業經濟效益與政府經費息息相關，使得防疫政策的擬定更加複雜。世界動物衛生組織（WOAH）為加強區域口蹄疫（FMD）控制，成立東南亞及中國大陸口蹄疫聯防計畫（SEACFMD），每年檢視該計畫推動狀況。本次第 26 屆 SEACFMD 次委員會會議及 SEACFMD 國家協調會議，即為汲取各國防疫、檢疫、診斷等經驗，並透過邀請歐洲專家、會議小組討論、經驗分享及意見溝通等方式，讓各與會成員國能有深度瞭解，並促成區域合作發展。

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壹、緣由及目的

世界動物衛生組織（WOAH）為加強區域口蹄疫（FMD）控制，成立東南亞及中國大陸口蹄疫聯防計畫（South East Asia and China Foot and Mouth Disease Campaign, SEACFMD），每年檢視該計畫推動狀況。本次第 26 屆 SEACFMD 次委員會會議（Sub-Commission Meeting）及 SEACFMD 國家協調會議（National Coordinators Meeting），於 2023 年 8 月 22 日至 24 日假馬來西亞吉隆坡（Kuala Lumpur）召開。為掌握 WOAH 對 FMD 之國際聯防策略，並汲取各國防疫、檢疫、診斷等經驗，本次會議我國由農業部動植物防疫檢疫署劉冠志技正與會。會議內容包括全球及區域之 FMD 近況及風險、SEACFMD 計畫之進展/挑戰/未來，除 FMD 外亦討論非洲豬瘟（ASF）、牛結節疹（LSD）及小反芻獸疫（PPR）等本區重要疫病。

貳、出國行程表

日期	星期	行程
2023.8.21	一	去程，由桃園國際機場出發，抵達馬來西亞-吉隆坡國際機場
2023.8.22	二	於吉隆坡 Pullman Kuala Lumpur City Centre Hotel & Residences，參加「第 26 屆東南亞及中國大陸口蹄疫聯防計畫及 SEACFMD 國家協調員會議」
2023.8.23	三	於吉隆坡 Pullman Kuala Lumpur City Centre Hotel & Residences，參加「第 26 屆東南亞及中國大陸口蹄疫聯防計畫及 SEACFMD 國家協調員會議」
2023.8.24	四	於吉隆坡 Pullman Kuala Lumpur City Centre Hotel & Residences，參加「第 26 屆東南亞及中國大陸口蹄疫聯防計畫及 SEACFMD 國家協調員會議」
2023.8.25	五	回程，由馬來西亞-吉隆坡國際機場出發，抵達桃園國際機場

參、會議議程表

第一天 (8月22日)

時間	會議及演講主題	主講人
08:30-09:00	報到	
第一節開幕會議		
09:00-09:30	由代表致歡迎詞，並請各與會人員自我介紹	1. 馬來西亞代表 2. WOH 代表 3. WOH RRAP 代表
第二節 會議介紹與 SEACFMD 推動進展回顧		
09:30-10:00	1. 會議目的 2. 審視 SEACFMD 活動推動進展 - 先前建議的後續行動	WOAH SRRSEA WOAH SRRSEA
10:00-10:30	中場休息及全體與會人員合影留念	
第三節 關於口蹄疫情況和活動的區域報告		
10:30-11:30	1. 近期口蹄疫事件的全球流行病學概述 2. 區域口蹄疫情況 3. 全球 FMD 控制策略與 PCP 階段 4. 問題討論	Pirbright WOAH SRRSEA Global FMD Working 全體與會者
第四節 國別報告－口蹄疫防治活動（海報）		
11:30-11:40	馬來西亞口蹄疫防治亮點	馬來西亞代表
11:40-12:30	國家海報介紹 -SEACFMD 成員 -非 SEACFMD 成員	
12:30-13:30	午餐及休息	

第五節 國別報告－口蹄疫防治活動（海報）		
13:30-15:00	海報展示 - Gallery Walk 海報會議的總結以及關鍵訊息	全體與會者
15:00-15:30	中場休息	
第六節 合作夥伴的最新動態，包括分享相關工具和資源		
15:30-17:00	1. 合作夥伴 2. WOH	合作夥伴
18:30	接待晚宴	

第二天 (8 月 23 日)

時間	會議及演講主題	主講人
09:00-09:05	前一天及重要訊息回顧	WOAH SRR-SEA/ Chair
第七節 FMD 相關研究的最新動態		
09:05-10:30	SEACFMD 成員 研究機構 參考實驗室 夥伴	研究者 合作者
10:30-11:00	中場休息	
第八節 加強口蹄疫防控		
11:00-12:30	1997 年至 2020 年 SEACFMD 活動評估簡介 World Cafe Session /小組討論 - 加強政策制定者的支持與承諾/尋求政治承諾 - 加強 SEACFMD 溝通 - 增加獲得優質疫苗的機會 - 加強區域生物安全 (跨境) 和監測系統	WOAH SRRSEA 全體與會者
12:30-13:30	午餐及休息	
第九節 2021-2025 年 SEACFMD 路線圖的 M&E 指標		
13:30-14:15	討論監測和評估基線指標 - 基線 - 目標 - 討論下一個步驟	非疫區國家及流行 行發生國家 WOAH
第十節 加強口蹄疫監測		

14:15-15:30	介紹正在進行的活動和主要挑戰 關鍵問題討論 (Menti 會議) - 疫情調查 - 取樣 - 疾病監測	
15:00-15:30	中場休息	
第十節 加強口蹄疫監測(續)		
15:30-16:15	關鍵問題討論 (小組討論) (印尼、緬甸、越南、馬來西亞) - 疫情報告 - 資訊共享	國家協調員和與會者
第十一節 加強口蹄疫防治的重點行動		
16:15-17:00	討論 - 未來 6 - 8 個月的優先行動 - 第 27 屆 SEACFMD 小組委員會和 WOAH 百年慶典	WOAH SRRSEA、 國家協調員和與會者

第三天 (8 月 24 日)

時間	會議及演講主題	主講人
09:00-09:05	前一天及重要訊息回顧	
第十二節 增強 FMD 和其他 TADS 控制中具有成本效益的綜效		
09:05-10:30	區域 GF-TAD 戰略更新 區域 ASF、LSD 和 PPR 情況及主要活動的最新情況	WOAH RRAP

	口蹄疫和其他跨界動物疫病的協同防治 - FMD 和 ASF (越南) - FMD 和 LSD (泰國) - FMD 和 PPR (蒙古) 加強口蹄疫與跨界動物疫病防治協同作用集思廣益 - 增強協同效應的挑戰 - 增強協同效應的解決方案	全體與會者
10:30-11:15	中場休息	
第十三節 結束與前進之路		
11:15-12:00	結論和建議	WOAH SRR SEA
12:00-12:30	會議結束 - WOH 的評論 - 東道國致閉幕詞	各國代表
13:30-17:00	實地考察	

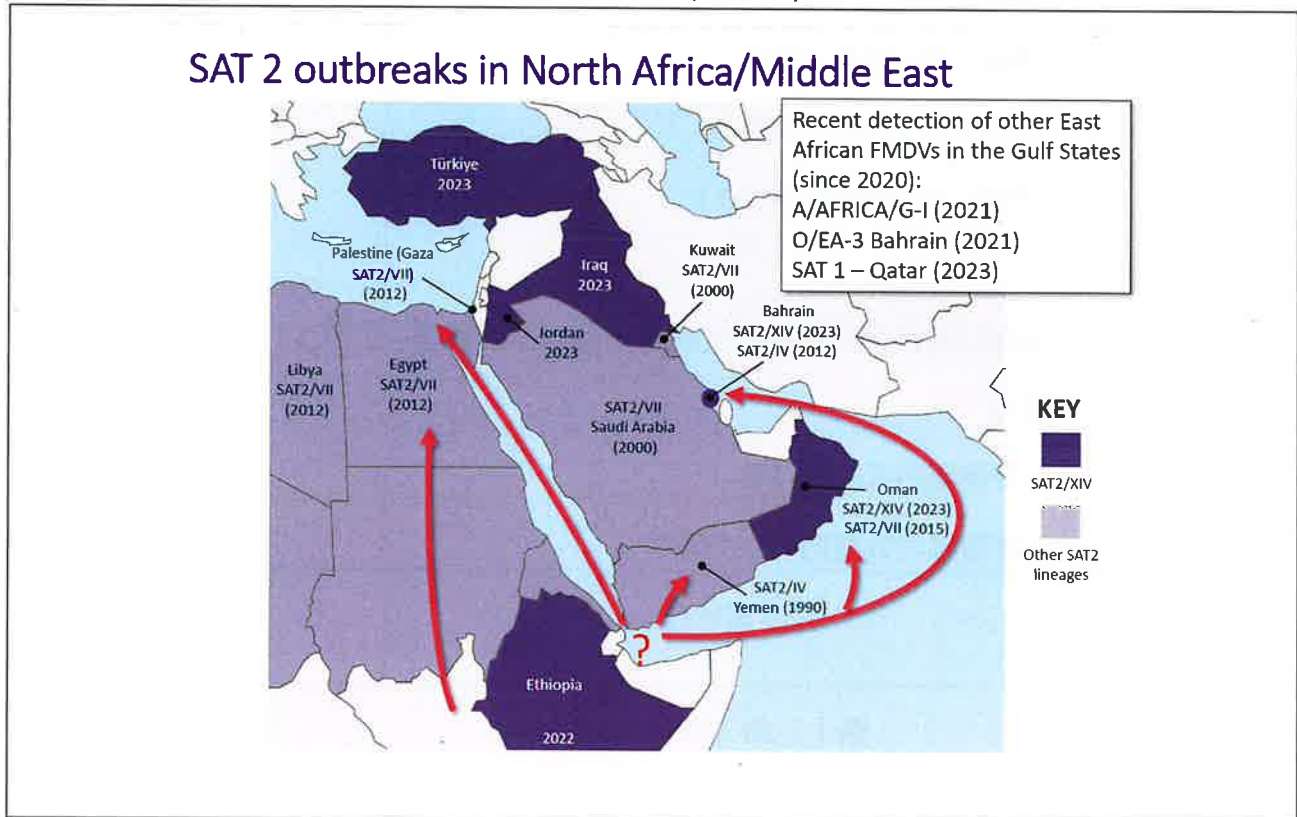
肆、會議及重要演講內容摘要

第一天 (8月22日)

一、全球更新資訊

由 Dr. Donald King 進行全球及區域豬隻疾病疫情狀態更新資訊報告，報告中指出口蹄疫在亞洲和非洲大部分地區持續流行（以及南美洲部分地區），維持特定病毒譜系(Seven endemic pools)，而六種流行的口蹄疫病毒血清型分佈不均，而自 2004 年以來全球未再檢測到 C 血清型；區域部分提及 SAT2/XIV toptype 導致中亞及北非等區域新的口蹄疫疫情爆發，包括在伊拉克、約旦及土耳其發生疫情首次檢測到血清型 SAT 2，而 toptype XIV

僅在 1991 曾經檢測到，而近期又在該區域出現(如圖一)。

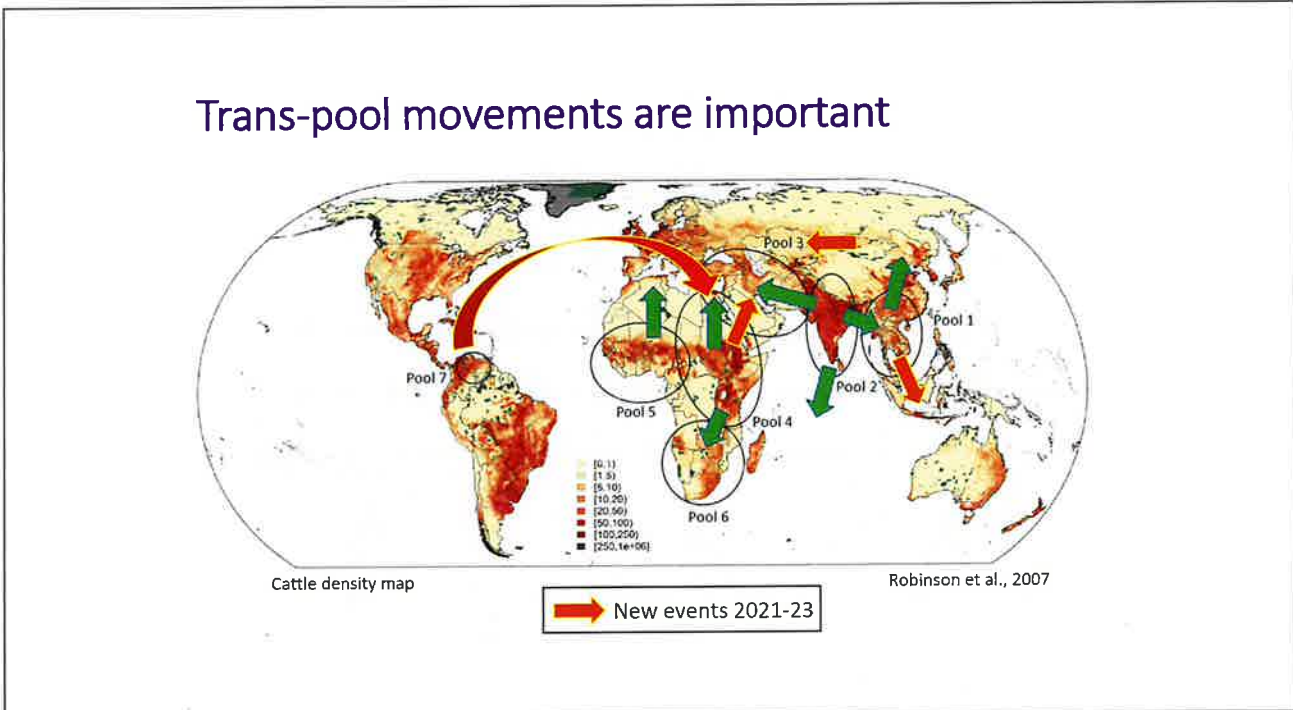


圖一：口蹄疫疫情(血清型 SAT 2)於北非及中亞發生情形

而 Dr. Donald King 表示，該區域疫情有幾點須注意，包括 1.SAT2/XIV 在未接受過感染及疫苗接種而沒有任何免疫力的幼齡動物中傳播。2.SAT2/XIV 感染（或繼發性感染）相關的死亡率和相應疾病嚴重程度的報告，顯示大型反芻動物較嚴重。3. 目前仍在調查該地區病毒的來源（和時間）以及 SAT2/XIV 引入該地區的風險途徑，但不諱言，會導致給予口蹄疫向西歐亞其他地區快速傳播的機會（包括高加索國家以及無口蹄疫地區（例如巴爾幹半島））。

另 Dr. Donald King 認為跨池移動很重要，因為不僅會影響及改變區域口蹄疫風險(包括無口蹄疫國家)，且也需考慮選擇新型別疫苗以控制疫情(如圖二)，目前 O/ME-SA/Ind-2001e 是全球最廣泛傳播的口蹄疫譜系(如圖三)。對於發生疫情國家如何選擇疫苗型別，其給予二點建議，包括 1.田間病毒與疫苗株之間的抗原配對。2.現場疫苗實際使用測試也非常重要（SSIS 和 PVM）。而疫苗使用控制失敗，原因不外乎 1.疫苗品質差（效力、146S 含量）。2.與流行病毒株的抗原配對較差。3.冷鏈故障。4.目標族群覆蓋率低。5.未遵循建議的疫苗接種計畫。6.未採取其他加強防控措施。其最後結論表示 FMD 的流行病學非常活躍，尤其在池 2 及池 1 之間的流行病學聯繫密切，故對於發生疫情國家，疫情發生場採樣至關重要，因為除要監測流行病學並評估疾病的影響，了解有無新病毒株出現，均會影響後續疫苗選擇和

疫苗部署策略。

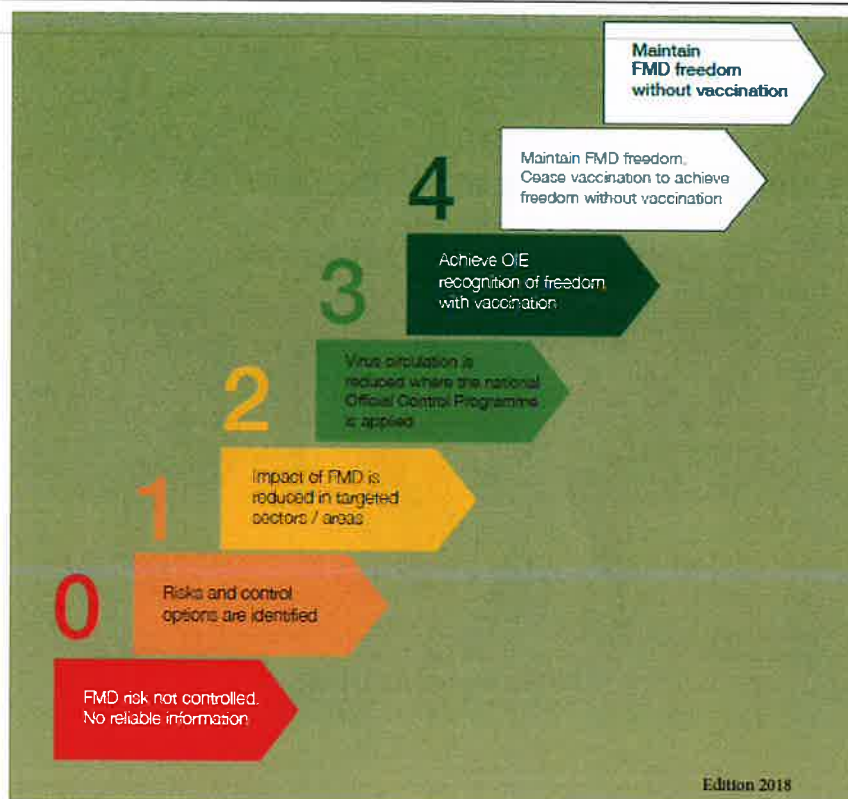


圖二：2021-2023 年口蹄疫血清型跨池移動情形

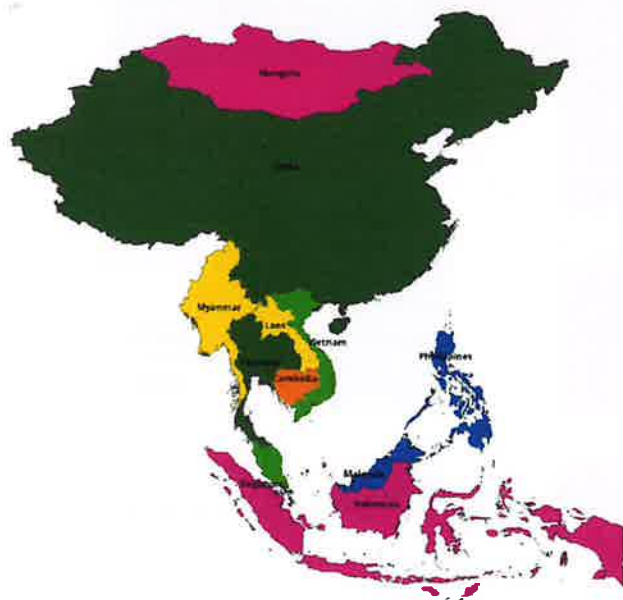
Country	O					A		Asia-1
	ME-SA/Ind-2001e	SEA / Mya-98	CATHAY	ME-SA / PanAsia	ME-SA / PanAsia-2	ASIA / Sea-97	ASIA/Ind	
Cambodia	2019	2016		2019		2016		
Laos	2020	2017		2018		2018		
Malaysia	2022	2016	2005	2020	2009	2014		
Myanmar	2021	2021				2021	2010	2017
Thailand	2021	2018	2012	2019		2021		
Vietnam	2022	2019	2018	2018		2017		2006
PR China	2021	2020	2022	2019		2019		2009
Indonesia	2022							
Mongolia	2022	2018		2017		2016		

圖三：口蹄疫於東亞發生血清型別譜系

在其他報告中，則介紹亞洲目前較新疫情發生情況，並以 WOHAI 口蹄疫漸進控制途徑 (PCP-FMD)(如圖四)，來說明 SEACFMD 各成員國最新控制進度(如圖五)。



圖四：WOAH 口蹄疫漸進控制途徑(PCP-FMD)



Country	PCP stage
Brunei	Free from FMD
Singapore	Free from FMD
Philippines	Free from FMD
Malaysia	Free from FMD
Sabah, Sarawak	Free from FMD
China	4
Thailand	4
Malaysia (Peninsular)	3
Vietnam	3
Laos	2
Myanmar	2
Cambodia	1
Mongolia	OCP withdrawal
Indonesia	Suspended

圖五：SEACFMD 各成員國最新口蹄疫控制進度

二、各國報告—口蹄疫防治活動

由各國以海報方式報告其國內口蹄疫防治活動情形，報告國家包括澳洲、汶萊、柬埔寨、中國大陸、印尼、日本、韓國(南韓)、寮國、馬來西亞、蒙古、緬甸、菲律賓、新加坡、泰國、東帝汶、越南及我國，我國由防檢署劉冠志技正進行報告(海報資料如附件)。

另節錄各國報告重點如下：

(一) 澳洲：

澳洲為口蹄疫非疫區，該國於 2022-2023 年已加強對進口貨物、入境旅客和郵件的生物安全要求，並在機場和郵件中心部署了 18 名新的生物安全官員，且為其培訓。在國際機場有針對性地部署偵查犬，並使用消毒踏墊對入境旅客的鞋子進行消毒，加強審查來自口蹄疫國家的肉類和其他風險產品的進口許可證和條件。另根據該國《2015 年生物安全法》，授予生物安全官員額外權力，可指導旅客清潔鞋子等風險物品，而為支持區域口蹄疫控制，與其他國家進行生物安全能力建設合作以及捐贈 400 萬劑口蹄疫疫苗給印尼。

對於國內防疫控制部分，該國制定了詳細且經過充分演練的口蹄疫應對計畫，而透過模擬演習不斷審試和測試政府和產業的準備。另也擬定澳洲獸醫緊急應變計畫(簡稱 AUSVETPLAN)，內容包含發生緊急動物疾病事件處置的方法，而口蹄疫疫情因應策略也有納入 AUSVETPLAN，其中包括應對口蹄疫入侵評估疫苗之使用。當發生疫情時，向受影響畜牧產業的補償給予，則規定在澳洲緊急動物疾病因應協議(簡稱 EADRA)中。另澳洲中央政府已承諾將提供超過 10.3 億澳元的額外資金，強化國內的生物安全系統。

(二) 汶萊：

該國有制訂國家反芻動物疾病監測計畫，口蹄疫監測也納在其中。另於 2021 年擬訂動物疾病與檢疫法，法規內容包括表列強制通報的動物法定傳染病(包括口蹄疫)，疫情發生後續管制、感染地區的宣布以及患病動物的處置。另將計畫與相關機關針對跨境動物疾病(TAD)進行兵推演練，預計分為二階段，第一階段為國內疾病防範及疫情處置，第二階段為與鄰近地區的跨境發生緊急狀態處置。而該國認為有待加強部分，包括 1.人力和專業知識有限(解決方案:對獸醫服務體系進行自我分析和評估，然後進行 WOAHPVS GAP 分析、為第一線人員提供培訓等(如邊境管制官員和工作人員))。2.缺乏對口蹄疫的認識(解決方案:辦理持續的宣導活動，如可利用網路的宣導，以涵蓋更多人)。3.動物疫病緊急應

變需要更新(解決方案:相關機關單位加入以強化應變能力、與其他國家交流分享經驗、進行模擬演練)。4.作業能量(Surge Capacity)須提升(解決方案:提供 SCAT 工具來預測和規劃實驗室能力)。

(三) 柬埔寨：

該國於 2022 年 1 月、2 月和 4 月沒有發生口蹄疫疫情，但 3 月、5 月和 6 月至少發生過一次口蹄疫疫情。然而下半年度口蹄疫案例數開始增加，於 7 月發生了 5 次，8 月則發生了 8 次。該國於口蹄疫防控相關立法包括動物健康與生產法、MAFF 聲明及 Pro# 134 178 227 343 等。在控制措施上，包括 1.疾病爆發調查、2.設置移動管制小組、3.疫區動物活動管制、4.鄰國進口活體動物設立檢查站，另仍持續進行村級宣導活動，並對所有相關利害關係人進行技術能力建置，而在牧場、屠宰場、疫區等強化消毒劑噴灑及生物安全。未來加強方向，包括落實執行現有立法管制和預防、加強疾病診斷能力與動物疾病監測系統、改善在區域口蹄疫控制和預防上的合作、提高在牧場的口蹄疫疫苗接種覆蓋率和生物安全實踐。

(四) 中國大陸：

中國大陸自 2019 年迄今發生口蹄疫案例型別均為 O 型，而 2018 年發生最後一例 A 型後未再檢出該型別。疫苗接種部分，依規定所有牛、綿羊和山羊、駱駝和鹿需接種 O 型和 A 型口蹄疫疫苗；而豬隻需接種 O 型，至於是否要接種 A 型疫苗，則由各省自行決定。目前該國共計有 8 家疫苗生產商，口蹄疫疫苗種類有 17 種，2022 年疫苗年產量共計 19.4 億劑，在 2023 年上半年產量 8.4 億劑。疫苗接種方式，若為商業牧場，由場內獸醫接種，若為後院型牧場，則由所在地政府動物衛生人員協助接種。而其分析國內仍有疫情發生原因包括:1.後院養殖比例仍高，其生物安全低。2.活體動物長距離運輸移動，動物緊迫大易染疫。3.邊境國界長，易有其他國家外來株入侵。未來防控強化部分包括:1.改善生物安全、加強疫苗接種及監測。2.進行分區防控，建立口蹄疫非疫區。3.加強國際合作。4.強化培訓及尋求中央經費支持。

(五) 印尼：

該國亞齊省和東爪哇省在 2022 年 5 月首次發生口蹄疫案例並已向 WOA 通報。案例有發生在牛、水牛、綿羊、山羊、豬和鹿身上，而 94%的病例發生在牛身上，目前評估情

況屬局部流行。截至 2023 年 8 月，38 個省份中已有 27 個省份受到影響。分別位在蘇門答臘島、爪哇島、加里曼丹島、蘇拉威西島、峇里島和西努沙登加拉省。流行的病毒株為 O/ME-SA/Ind-2001e。目前以疫苗接種方式控制疫情，接種策略是全面接種；而動物的優先目標是會以牛和水牛優先進行接種，其他養殖的易感動物及被販運的動物均會接種疫苗。施打疫苗自 2022 年 6 月 14 日起已在該國 29 個省份實施，已為 7,748,129 頭牛、161,716 頭水牛、2,743,431 頭綿羊和山羊以及 507,418 頭豬接種疫苗。該國也於 2022 年預算中編列 600 億印尼盾，以在農場、市場、檢查站、檢疫站提供有效的消毒劑和提昇消毒設備。在動物識別部分，為使用耳標掃描二維碼，預計 2023 年目標族群為 600 萬頭，現已應用超過 470 萬頭。為防堵疫情擴散，已有設置 70 個活動式檢查站和 52 個檢疫站，另公私部門分工合作，私部門自行提供場內疫苗和進行接種，它們通常是有規模的飼養場(包括大型乳牛場)。另為處理疫情，該國建立口蹄疫特別工作小組，小組成員包含災害管理局、警察機構、陸軍機構、農業部、當地畜牧部門。該國口蹄疫防控所遭遇困難及擬解決方案包括:1.現場防疫人員數有限，而自由放養使得處理動物變得困難(解決方案:增加新的疫苗接種人員(學生、農民)，並提供處理動物的相關設備)。2.農民拒絕使用疫苗，可能原因包括副作用、案例數減少或缺乏正確訊息(解決方案:強化對利害關係人說明關於不接種疫苗的影響和進行風險溝通)。3.並非所有接種疫苗的動物都有釘掛耳標，且識別資料未與疫苗接種資料架接(解決方案:進行系統資料整合)。4.其他疾病控制活動可能會使口蹄疫疫苗接種進展緩慢(解決方案:增加疫苗接種人員數量，調整其他疾病疫苗接種、防疫策略和時間表)。

(六) 日本：

日本最後一例口蹄疫案例在 2010 年 4 月發生於宮崎縣，造成經濟損失估計約 170 億美金(2010 至 2014 年)。經由一系列防疫處置(撲殺、掩埋、移動管制、消毒、緊急疫苗接種及撲殺免疫後的動物)，終於 2011 年 2 月 5 日 WOAHI(前身為 OIE)恢復其不施打疫苗口蹄疫非疫國認定。該國目前維持無口蹄疫狀態有預防與準備策略包括，預防主為針對邊防檢疫作業，包括 1.對於活動物及動物性產品進口需提供出口國主管機關核發的健康證明，並禁止從疫區進口相關商品。2.針對旅客部分則實行詢問乘客、檢查隨身物品並處置違禁品、於全國部署搜查犬並對鞋底/隨身物品進行消毒等措施。準備策略為 1.及早發現並通

報(包括預警系統建立、縣獸醫對農場進行現場檢查及實驗室診斷)。2.迅速緊急防疫處置(包括設立移動管制區、撲殺疑似動物(24小時內)、處理動物屍體(72小時內，以掩埋或焚燒方式)、消毒、流行病學調查及監測(含野生動物)等)。而該國認為未來所需加強為為周邊國家疫情爆發所增加的風險需進行因應措施，包括 1.請航空公司在出發櫃檯發布機上廣播和散發傳單。2.要求旅行社告知旅客禁止進口動物產品的訊息。3.提高郵輪乘客的防檢疫意識。

(七) 韓國(南韓)：

韓國近期發生口蹄疫疫情為在 2023 年 5 月，共計 11 個案例(9 例在清州市(市)，2 例在曾平郡(郡))，受感染的動物共計 36 頭(35 頭牛隻、1 頭羊隻)，經檢測病毒血清型別為 O/ME-SA/ind-2001e，至於發生原因仍在調查中，但初步認為為鄰國發生案例增加，由境外移入可能性較高。而為控制疫情，其採行防疫措施包括撲殺、疫苗免疫、移動控制及其他措施。撲殺部分為採行全場清場方式，統計自 2019 年迄今已撲殺 1,571 頭動物(包括 1,510 頭牛隻、61 頭羊隻)。疫苗免疫部分，為採行全面施打疫苗(包括牛、豬及山羊)，但仍有排序免疫優先順序，以發生疫情影響的城市其牲畜為最優先免疫，而發生疫情城市的鄰接城市為次優先免疫，最後則是全國其他的牲畜。移動管制部分主為針對畜牧相關車輛、設施和工人的行動控制，包括 1.口蹄疫爆發後，政府立即對所有易感牲畜相關的車輛和工人發出臨時禁止移動的命令。2.暫時關閉牲畜市場，特別是受影響城市及周邊城市的市場，至口蹄疫疫情處置完畢。3.將整個受口蹄疫影響的城市設置為保護區，控制其區域內易感動物的活動，並根據後續口蹄疫情況發展狀況，逐步縮減區域範圍。其他措施部分，包括在全國範圍內對所有農場和畜牧業相關設施採取消毒措施，另政府向民眾通透明公開口蹄疫疫情情況並加強宣導促進遵守疾病管制措施。而其認為未來須加強部份，包括傳播風險管控及更快速進行疫苗免疫，加強傳播風險管控部分，因受發生疫情農場影響其附近的農場被傳播口蹄疫的風險將非常高(解決方案：為快速應對口蹄疫的活動包括撲滅、行動控制和疫苗接種)；另要加強更快速進行疫苗免疫部分，其需克服部分為進行緊急疫苗接種時農場需有足夠數量的疫苗(解決方案：政府控制疫苗的供需，向所有農場免費供應疫苗)。

(八) 寮國：

有關該國口蹄疫疫情狀態，2018年在該國阿速坡省檢測到的A血清型迄今未再發現，在2019年和2020年則流行O型血清型，而從2022年迄今尚無發生口蹄疫疫情。因該國邊境與中國大陸接鄰，故有報告該國至中國牛隻貿易口蹄疫管制區作法，其該區域分為三部分包括無口蹄疫區域（內有動物檢疫）、緩衝區域及收集區域。在口蹄疫自由區域，有設置檢疫站，牛隻出口30天前需進行檢疫(包括常規臨床檢查、採血進行LPB ELISA測試，另有飼養約30隻哨兵動物，定期進行NSP和Probang測試。緩衝區域部分，現該國約有22個村莊屬於緩衝區，該區域共計擁有1800多頭牛和水牛，區域內實施口蹄疫疫苗接種及疫苗接種後監測(約每3個月採血進行NSP檢測)。另收集區部分，此區域內有收集農場，移至隔離區前需先進行隔離45天，該區動物會進行耳標釘掛且接種HS、FMD和LSD疫苗2次(分別於第0至4天以及30-35天後)。統計該國牛隻和水牛出口至中國大陸數量，2021年共出口2013頭，後因爆發LSD而停止出口，而在2023年9月底再次開始出口。於口蹄疫防治遭遇困難部分，包括1.口蹄疫疫苗價格高，死亡頭數少，造成農民接種動物的意願降低(解決方案：尋求優質、價格便宜的口蹄疫疫苗)。2.缺乏實作工作人員、資金和設備(解決方案：在地方層級發展和培訓新的勞動力，進行獸醫輔助專業人員和鄉村獸醫工作者(VVW)的能力建設和培訓)。3.農民延遲通報或少報(解決方案：完善監測和疾病報告系統)。4.放養生產體系，缺乏公眾意識及生物安全措施(解決方案：加強口蹄疫高風險地區的公眾意識和風險溝通)。5.動物和動物產品的國內和跨境流動，增加防堵困難。

(九) 馬來西亞：

該國在2022年統計有31個口蹄疫案例(牛隻28例、山羊1例及豬隻2例)，血清型別為O/ME-SA/Ind2001e。因該國部分區域已為口蹄疫非疫區，故推動之防疫工作不盡相同，在疫情流行區域的防治活動，包括疫苗接種計畫、宣傳活動及進行口蹄疫風險評估；另在口蹄疫非疫區(沙巴州(Sabah)和砂拉越州(Sarawak)維持無口蹄疫狀態)的活動，包括預警監測計畫，並分別於沙巴州和砂拉越州均有設立專家輔導團隊。而該國口蹄疫防疫遭遇最大困難為口蹄疫疫苗覆蓋率低，其原因包括私人獸醫為牲畜提供服務的興趣不高(轉往小動物發展趨勢)、牧場沒有足夠的經費購買疫苗及現場人力不足。其認為可行性解決方案，

包括增加疫苗採購預算、編列預算委託私人注射人員協助疫苗注射、鼓勵私人獸醫為牲畜提供相關醫療服務並提供相關獎勵。

(十) 蒙古：

該國於 2021-2022 年，共有 109,796 頭牲畜感染口蹄疫，分佈在 19 個省份。血清型經 Pirbright 實驗室檢驗為 O/ME-SA/Ind 2001。為控制口蹄疫疫情，進行下列防疫工作之推動，包括 1.進行防控措施規劃。2.評估口蹄疫發生條件(監測及研究)。3.為各級公民和牧民提供資訊(包括蘇姆、省、國家(國家緊急事務委員會和外交部)等層級)。4.發生疫情時限制全國牲畜及賽馬的移動。5.相關經費、財政資源的爭取與人力的調動。在前述措施的協同實施後，於 2022 年 10 月迄今無發生口蹄疫案例。該國認為未來有待強化部分，包括 1.根據疫情情況滾動式更新 FDM 管控策略。2.將修訂後的策略(FMD 國家控制計畫)提交給 WOAHP，並請其專家提供相關建議。3.在靠近邊境口岸的有疫病傳播風險的蘇姆和省份對其牲畜進行疫苗接種。4.為確保無疫病入侵，加強宣導及促進安全交易。5.加強與周邊國家和地區合作。

(十一) 緬甸：

該國 2022 年 1 月至 2023 年 7 月無發生口蹄疫疫情，目前所處的 PCP-FMD 階段為第 2 階段，而該國目標於 2025 年 12 月進階到 PCP 第 3 階段。其認為後續關鍵工作，包括 1.需從源頭解決口蹄疫問題。2.建立並擴大口蹄疫無可能發生區域。3.保護及維持無口蹄疫區域。

(十二) 菲律賓：

該國主要報告為維持無口蹄疫狀態的相關策略，包括 1.加強邊境旅客手提肉製品檢驗。2.對未經在 SPS 進口許可清單上的貨物進行沒入。3.強化機場和海港檢查。4.在活動物運輸樞紐地點設立檢查站。另有為因應口蹄疫疫情擬訂應急計畫，內容包括 1.成立技術工作小組(TWG)以滾動式修訂口蹄疫(FMD)緊急準備計畫(EPP)。2.與口蹄疫疫苗供應商協調。3.更新其 FMD 資訊卡上的 FMD 協調員名錄。4.向預算管理部(DBM)要求其提供口蹄疫疫苗緩衝庫存儲備的經費。5.在民答那峨島(Mindanao)進行初步 FMD 兵推模擬演練以及 FMD 前線防疫人員的裝備整備。而該國在口蹄疫防控上遭遇困難包括 1.口蹄疫監測活動因非洲豬瘟(ASF)和禽流感(AI)防控工作而被擱置(解決方案：實施口蹄疫和其他動物健

康計畫之間的協同作用，以最大限度地利用資源)。2.向國家 FMD 實驗室提交樣本的人員後勤問題(解決方案：進行與地區和 NAIA 獸醫檢疫官員的人員協調)。3.新和年輕的現場人員對 FMD 警覺性不足(解決方案：對於人員進行疾病識別和診斷的重新訓練)。

(十三) 新加坡：

該國報告為維持無口蹄疫狀態的相關策略，主要為 4 大策略包括 1.早期預警監測。2.嚴格的生物安全措施和風險評估。3.進行立法和監管權力。4.協調疾病因應與控制。在早期預警監測部分，為依據該國《動物與鳥類法》若有發現需強制通報口蹄疫病例，另對易感動物進行年度監測(對家養和野生族群進行臨床和血清學監測)。而該國生物安全措施和風險評估部分，基於獸醫專業風險評估為針對活體易感動物(豬、羊)和動物產品(肉類或肉製品)制定嚴格的進口條件，並與 WOAH 所訂標準保持一致。擬定肉品及肉製品進口認證制度。利用新科技技術支援例行檢查（例如使用閉路監視器進行即時遠端檢查），以便及時及靈敏地檢測疾病。在進行立法和監管權力部分，在該國《動物與鳥類法》中規定了實施監管措施的立法授權，以便在國內儘早發現、預防和控制口蹄疫。該法也授予公務獸醫在動物疾病(包括口蹄疫)爆發時，對動物進行調查、監視、疫苗接種和銷毀的權力，以便快速有效地應對動物疾病爆發。最後協調疾病因應與控制部分，為建立結構化的緊急應變系統來應對口蹄疫等動物疾病事件，另定期進行訓練和模擬演練，增強應對動物疫病事件的能力。而在該國應急計畫上，重點包括 1.進行疾病爆發緊急處理系統的結構化，由包括相關政府機構和產業利益相關者在內的結構支持。2.對於現場和實驗室調查以及情況評估，可立即對可疑場所下達隔離令，立即停止車輛、易受影響的動物、接觸材料、人員以及乳製品和肉類產品的流動，並在相關情況下進行撲殺及銷毀。另透過焚燒處理屍體和相關接觸材料處理，以對場所及所有相關設備及車輛進行徹底清潔淨化。至於其需加強部分包括 1.繼續滾動式調整應急計畫，並進行模擬演習(例如針對其他豬隻疫病的兵推演習)和跨界動物疫病(TAD)相關疫情(例如 2023 年首例野豬 ASF 病例)(解決方案：汲取非洲豬瘟疫情的教訓，加強針對跨界動物疫病(包括口蹄疫)的現有生物安全措施)。2.由於新加坡嚴重依賴進口牲畜作為食品，海外爆發口蹄疫可能會擾亂新加坡的糧食安全(解決方案：繼續依照 WOAH 有關 FMD 防檢疫建議，維持進口管制措施，並加強進口邊境前預警機制)。3.人員需要持續培訓，以使疾病調查團隊在臨床症狀識別、流行病學和流行病學調查方案方

面得到良好的訓練(解決方案：與 One Health 機構合作定期進行能力建構活動和知識交流)。4.土地稀缺限制了疫情爆發期間垃圾掩埋場處理動物屍體的量能(解決方案：與相關政府機構和行業利益相關者合作完善應急計劃，包括生物廢物處置)。5.持續滾動審視與口蹄疫和其他跨界動物疫病生物監測和控制相關的國家立法(《動物和鳥類法》)。

(十四) 泰國：

有關該國口蹄疫疫情狀態，於 2022 年共計 110 例(乳牛 56 例、肉牛 49 例及水牛 5 例)，而 2023 年迄今共計 8 例(乳牛 4 例及肉牛 6 例)，但均無豬隻發生口蹄疫。在口蹄疫防控活動上，主要有三部分，包括改善農場生物安全、疫苗免疫接種及疫情應對。在改善農場生物安全部分，在牛場推動良好農業規範 (GAP)、良好的農業管理(GFM)及依據該國動物流行病法，B.E. 2558 (2015)部會級法規第 7 條強化一般生物安全系統，符合前述規範管理且無 FMD 及 NSP-陰性農場，政府將給予相關認證。疫苗免疫接種部分，乳牛每年針對三種血清型別施打疫苗，而對肉牛、水牛、山羊及綿羊則施打二種血清型別疫苗。疫情應對部分，發生疫點將執行樣本採集及病害動物的檢疫與治療，向後追溯及向前追蹤，進行嚴格的生物安全措施；在疫點半徑 5 公里內將進行環帶免疫、限制動物移動及設置消毒檢查點；而疫點半徑 10 公里內主要進行臨床監測(被動和主動)和提高防疫意識，包括進行危險區域消毒、改善農場生物安全、促進畜牧網絡/合作社之間的合作。而其在口蹄疫防控所遭遇困難包括 1.小農戶生物安全措施低(解決方案：增加激勵措施並鼓勵農民改善農場生物安全，從基本 GFM 到 GAP)。2.非法動物移動(解決方案：透過與其他相關機構的密切合作，加強邊境管制)。3.防疫人力不足(解決方案：私營部門對疫苗接種運動和疾病監測計劃的堅定支持和參與)。

(十五) 東帝汶：

該國有擬訂口蹄疫應急計畫草案，同時也是適用多疾病的應急計畫。另規劃於 2024 年進行全國性 FMD 模擬演習，而也將辦理國際研討會介紹近期無口蹄疫證明調查結果，後續將向 WOAHP 重新提交 FMD 非疫區狀態申請。其所遭遇困難包含 1.人員工資和活動經費缺乏(解決方案：預算需要與內閣和議會成員支持)。2.需改進立法/法規以增強獸醫服務能力(解決方案：與內閣和高級官員的合作)。3.加強與農民協商—缺乏農民組織(解決方案：由捐助者和非政府組織幫助農民組織產業團體，強化與政府間溝通協調)。

(十六) 越南：

有關該國口蹄疫疫情狀態，於 2022 年共計發生 17 例(擴及 9 個省，僅發生在牛隻(受感染共計 1,288 頭))，而於 2023 年迄今共計發生 19 例(擴及 8 個省分，僅發生在牛隻(受感染共計 618 頭))，經 ELISA 分型檢測和定序確認均為 O 型口蹄疫(O/ME-SA/Ind-2001e)。在口蹄疫防控活動上，主為依據實施總理批准的《2021-2025 年國家口蹄疫預防與控制規劃》(2020 年 10 月 22 日第 1632/QD-TTg 號決定)，推動全國使用線上報告平台(越南動物健康資訊系統(VAHIS))。而疫苗接種的動物主要是牛、水牛、母豬和野豬。此外，根據口蹄疫流行病學和當地資源情況，省級動物衛生主管部門應報告並建議當地政府考慮並決定在合適的情況下對何種類型的動物使用疫苗。對於應免疫動物接種高抗原有效量疫苗(> 6PD₅₀)，每年接種 2 次，間隔 6 個月，以確保應免疫畜群其免疫覆蓋率達到 80% 以上。在 FMD 監測有臨床監測(被動監測)、病毒監測(主動監測)以及接種後監測。而該國也持續進行無口蹄疫農場和區域認定(屬國內認證)，在該國農場獲得口蹄疫無疫區認證統計，於 2022 年 267 個農場通過認證，另 2023 年迄今有 20 個農場通過認證。在推動口蹄疫防疫遭遇困難部分，包括國內小規模農場比例高及難以控制省際和跨境動物流動。所提解決方案包括 1. 邊境鄰國非官方通道動物移動(應是指走私)加強派遣人員及進行控制。2. 持續對畜牧場的牛、豬使用高效力口蹄疫疫苗(>6PD₅₀)。3. 持續加強口蹄疫監測(包括主動和被動監測)、疫苗接種後監測和疫情應變。4. 建立畜禽無疫區和分區，以供應進口和國內消費。

第二天 (8 月 23 日)

World Cafe Session / 小組討論

近年 WOA 召開實體會議，其會議時常有安排小組討論活動，由主辦單位先行設定各種議題，並將各國成員打散(同個國家亦分散在不同組別)分組，各組對所設定議題來集思廣益提供意見，最後小組需綜整全組意見並於會中進行報告。本次參加會議不例外也有此活動，且更進階提升，除將全部成員分成 4 組(我國分配在第 4 組，如圖六)及設定 4 個議題(如圖七)外，各組對 4 個議題均需進行討論及綜整意見且有限制討論時間(類似跑臺概念)，最後各組對 4 個議題均要進行報告。而本次設定 4 個討論議題有 1. 強政策制定者的支持與承諾/尋求政

治承諾。2.加強 SEACFMD 溝通。3.增加獲得優質疫苗的機會。4.加強區域生物安全（跨境）和監測系統。經由此活動設計及進行，各個議題均充分討論及意見交流。

TEAMS (colour code of post-it notes)

Group 3		Group 4	
Mongolia	Narantuya Ayushjav	Brunei	Hamsiah Mohd Saat
Philippines	Arlene Asteria	Vietnam	Ja Hoang Long
Thailand	Sith Premashthira	Chinese Taipei	KuanChih Liu
South Korea	Subeom Lee	Singapore	Jia Jun Fong Guo
Biogenesis Bago	Juver Membrebe	Australia	Jennifer Davis
DVS Malaysia	Salina binti Amad Bugis	BI	Carlo Magno Unalivia Maala
DVS Malaysia	Siti Norsyakirah binti Hashim	DVS Malaysia	Muhammad Nazri
DVS Malaysia	Yahasmida binti Yaacob	DVS Malaysia	Khairina Akmar
DVS Malaysia	Noor Asyikin binti Abu	DVS Malaysia	Shaharul Akmar bin Talib
DVS Malaysia	Nor Azhani binti Kamaruddin	DVS Malaysia	Andrea Lim Li Li
DVS Malaysia	Ainin Syakirah binti Rosli	DVS Malaysia	Marni binti Mohamad
		DVS Malaysia	Ong Jin Seng

Karma and Don
Ashish and Jamaliah

圖六 World Café 我國被分配組別

CAFÉ BOOTH

Participants will be divided into four groups

Each group will be assigned with one booth during first round (My café)

Thereafter group rotate and will have opportunity to visit each booth before coming back to original booth (My café)

My café is assigned with facilitators who will assist provide guidance (facilitator will remain at the station)

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graph TD
    WC[WORLD CAFE] --- G1[GROUP 1  
Fit for purpose surveillance system]
    WC --- G2[GROUP 2  
Incentives and pathways for livestock movement]
    WC --- G3[GROUP 3  
Access to quality vaccines and effective vaccination]
    WC --- G4[GROUP 4  
Multi-disciplinary and multisectoral efforts]
            
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圖七 World Café 討論議題

第三天（8月24日）

進行前天會議重要回顧，後 WOAAH 進行增強 FMD 和其他 TADS 控制成本效益綜效的報告，而部分國家則分享該國口蹄疫和其他跨界動物疫病的協同防治成果報告，包括越南報告 FMD 與 ASF 協同防治、泰國則報告 FMD 與 LSD 協同防治及蒙古報告 FMD 與 PPR 協同防治。最後結束會議則由 WOAAH 針對本次會議討論及意見收集撰擬之建議草案與全體與會者進行最後討論及確認，最後確認之建議草案內容如下：

WOAH 考慮到

- 一、自 1994 年東南亞口蹄疫控制小組委員會成立、1997 年發起 SEACFMD 活動以及在中國大陸和蒙古納入後擴大 SEACFMD 活動以來，該地區取得的活動成果。
- 二、於 2020 年 12 月舉行的第 25 次 SEACFMD 小組委員會會議批准了 SEACFMD 2021-2025 年路線圖；2022 年 3 月，第 26 屆 SEACFMD 小組委員會批准了 2021-2025 年 SEACFMD 路線圖的監測和評估(M&E)架構。
- 三、1997 年至 2020 年 SEACFMD 活動評估結果。
- 四、2021-2025 年 SEACFMD 路線圖的實施進度。
- 五、SEACFMD 成員國現有的 FMD 狀況，包括 FMD PCP 階段以及全球和區域層面的 FMD 情況。
- 六、不同血清型 FMD 病毒在該地區的動態傳播以及引入新病毒譜系的潛力(例如 O/ME-SA/SA-2018)。
- 七、最近出現的跨界動物疾病(ASF、LSD 和 PPR)侵入該地區。
- 八、批准亞洲及太平洋地區 2021-2027 年區域性全球跨界動物疫病策略。
- 九、區域協調對於有效控制口蹄疫的重要性。
- 十、該地區在控制口蹄疫和其他跨界動物疫病方面面臨的挑戰。

故本次 2023 年 8 月 22 日至 24 日在馬來西亞吉隆坡舉行的第 26 屆 SEACFMD 國家協調員會議為使未來 SEACFMD 路線圖活動實施更好提出了以下建議；並同時指引未來的 SEACFMD 活動：

一、在監控部分

1. 調整現有的統計方法來量化整個區域的口蹄疫感染情形，並納入各成員國之間的系統化血

清監測資料，以約略估計區域流行率。

2. 對報告的疫情其病毒進行序列分析，以便更了解口蹄疫在該地區的傳播模式。
3. 繪製口蹄疫風險路徑與價值鏈沿線地區存在的口蹄疫病毒譜系。
4. 利用多準則決策分析(MCDA)技術進行空間風險分析。
5. 對東南亞和中國大陸的反芻動物運輸路線進行研究，納入加強研究牲畜安全貿易的各種策略。
6. 使用 SEACFMD 辦公室提供的範本(將分發給所有國家)評估口蹄疫在最小行政層級(例如村莊/公社等)的存在歷史(過去 1 年、2 至 3 年和 5 年)。

二、疫苗接種

1. 倡導全地區疫苗品質檢測。
2. 整理有關 SEACFMD 會員使用 FMD 疫苗的區域信息，包括會員提交的年度疫苗接種報告，以及有關生產/採購疫苗劑量、進行疫苗接種的信息；以及描述不同行政級別的 (i) 全面(預防性)疫苗接種和 (ii) 針對性(抑制性)疫苗接種的疫苗接種地圖。
3. 繼續提高我們對接種牲畜疫苗接種反應的了解(包括協調該地區使用的 ELISA 測試的校準工作以及與 VNT 測試結果的比較)。

三、生物安全和動物移動

1. 成員進行風險評估研究，指導他們建立無疫區以促進牲畜貿易。
2. 探索並衡量可能將新病毒引入該地區的風險。

四、宣傳與溝通

1. 製作使用優質疫苗重要性的政策簡報。
2. 為政策制定者製作宣傳資料，宣傳口蹄疫和其他跨界動物疫病預防和控制的重要性。
3. 開發針對貿易商和成員國的口蹄疫風險溝通資料，向目標利害關係人傳播口蹄疫風險溝通資料(包括新開發和翻譯的數位資料)，以提高口蹄疫防治意識。

五、橫向問題

1. 確定口蹄疫和其他跨界動物疫病的能力建構和訓練需求，以適應不斷變化的環境、新興和重新出現的疾病以及技術和知識的進步。
2. 確定並發展口蹄疫控制與其他跨界動物疫病或其他畜牧生產/衛生活動之間的協同作用。

3. 發展和維持合作夥伴和相關利害關係人之間的積極合作，以預防和控制口蹄疫和其他相關跨界動物疫病。
4. 舉辦安全貿易研討會，交流關於 WOH 國際標準的角色、進出口國的角色以及 SPS 市場准入要求的知識和理解。
5. 組織 WOH SRRSEA (SEACFMD 秘書處) 和 SEACFMD 成員之間的雙邊討論，審查 2021-2025 年 SEACFMD 路線圖的實施進展情況和國家層面的監測和評估目標。

六、其他事項

1. 支持柬埔寨制定基於口蹄疫風險的策略計畫。
2. 鼓勵該區域的進口國和出口國在運輸協議中納入使用高品質疫苗（例如使用 6 PD50）為動物接種口蹄疫疫苗的要求。

七、商請事項

1. 商請泰國於 2024 年 3 月主辦第 27 屆 SEACFMD 分會會議。
2. 商請柬埔寨於 2024 年 8 月主辦第 27 屆 SEACFMD 國家協調員會議。

八、WOAH 致謝

1. 感謝馬來西亞政府成功主辦 SEACFMD 國家協調員第 26 次會議。
2. 感謝澳洲和中國大陸政府對 SEACFMD 活動持續的財政支持。
3. 感謝所有 SEACFMD 會員、非 SEACFMD 會員和合作夥伴積極參與本次會議。

伍、心得與建議

經本次會議瞭解目前與會代表國國內口蹄疫最新疫情現況及其他跨境動物疫病防控情形。因東亞各國在畜牧產業鏈及飼養有許多共通之處，可藉由它國防疫經驗來檢視及加強國內現階段不足處，最後藉由參與國際會議可強化與區域國家之聯結，而我國未來有機會也應積極參與相關會議，以強化與周邊鄰近國家之疫情訊息、政策擬訂或實驗室診斷能力等相關交流。

陸、致謝

感謝 WOAHA、FAO 及其亞太代表處支持出席會議之出國旅費與相關安排，以及對東亞地區口蹄疫共同防治之協調與努力。

柒、附錄

一、行程照片



圖一、第 26 屆 SEACFMD 國家協調員會議全體與會人員合影



圖二、我方於會中與馬來西亞官員進行經驗交流



圖三、我國劉冠志技正於會中進行簡報



圖四、參與 World Cafe 小組討論



圖五、與會場中我國海報合影

二、研討會簡報資料（如後附）



**CHINESE
TAIPEI**



World Organisation
for Animal Health
Founded as OIE



Name: Guan-Jih Liu
Position: Specialist

FMD Situation

June 2018 FMD free area with vaccination for Kinmen

June 2020 FMD free area without vaccination for Taiwan, Penghu, Matsu



KEY STRATEGIES IMPLEMENTED TO REGAIN FMD FREE STATUS

Confidence to Stop Vaccination

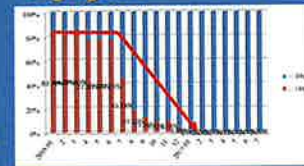
Before cessation of vaccination, in the zone covering Taiwan, Penghu and Matsu:

1. FMD vaccination rate in cloven-hoofed animals exceeded 90% in the zone.
2. FMD immunization coverage rate at farms exceeded 80% in the zone.
3. Test results of Co-habitation test, the environmental samples collected from pig auction markets and pig slaughterhouses as well as sentinel pig experiments all indicated that FMD virus was eliminated from this zone.

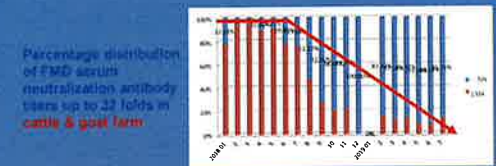


Measures After Stopped Vaccination

1. Serological surveillance for
 - (1) VNT
 - (2) NSP reactors followed by clinical investigation
2. Surveillance of Wild even toed ungulates



Percentage distribution of FMD serum neutralization antibody titers up to 16 folds in pig farms



Percentage distribution of FMD serum neutralization antibody titers up to 23 folds in cattle & goat farms

PREVENTION & PREPAREDNESS STRATEGIES TO MAINTAIN FMD FREE STATUS

Active Surveillance (On-farm)

- Clinical inspections
- Serological testing: 600 pig farms and 300 ruminant farms per year 15 serum samples per farm based on epidemiological principle

Active Surveillance (Auction market)

- Clinical inspections
- Serological testing for NSP antibody on a daily basis 1-2 animals per original farm around 20 thousands samples/year

Passive surveillance

- Clinically suspected cases are traced back to the original farm to conduct:
- Movement restriction
 - Follow-up serological and virological sampling and testing



Other Prevention Measures

- Application of biosecurity principles at the farm level :
 - On and off farm control
 - Personal and vehicle biosecurity: Changing outer clothes and footwear when moving between different buildings, with the frequent use of disinfection baths and separate equipment
 - Routine cleaning and disinfection
 - Selective purchasing and quarantine
 - Self monitoring and reporting suspected cases
- Application of vehicle control through disinfection of transporting vehicles and establishments at auction markets and slaughterhouses
- Transporting vehicles are equipped with GPS
- Awareness program and education for farmers and stakeholders



Constraints and Solutions



Future activities

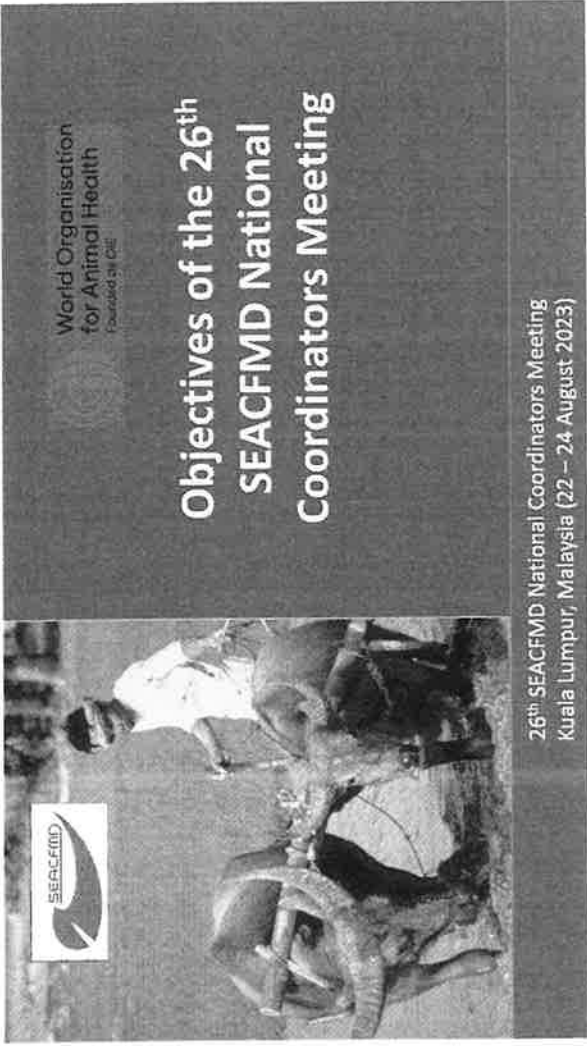
Continuous surveillance (Serological and Clinical)

Education of the farmers

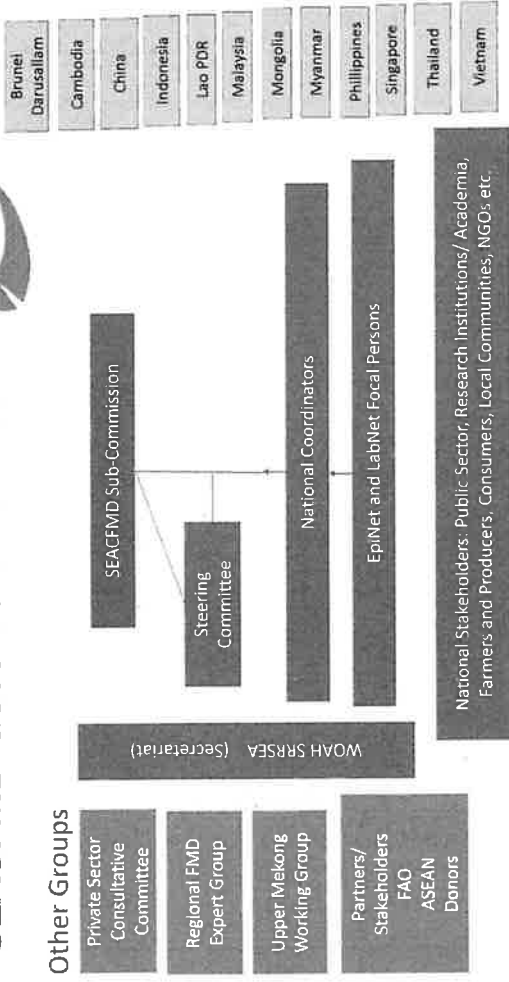
Improve biosecurity level on farm

Continue to strengthen Inspection of borders





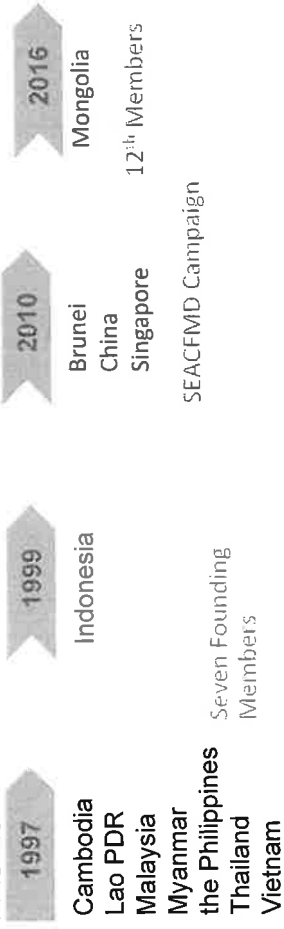
SEACFMD Governance Structure



Background

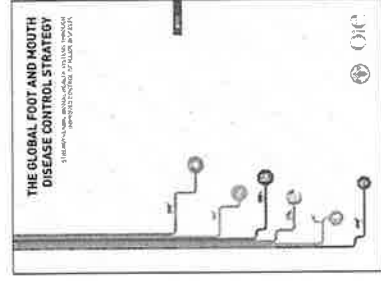
SEACFMD Campaign is a regionally coordinated programme to control FMD in the Sub-region. WOAHA continues to work towards controlling FMD and its negative effects on economies and livelihood in South-East Asia, China and Mongolia through SEACFMD Campaign

Timeline



Alignment of SEACFMD Campaign with Global Strategy

2012



2016 - 2020

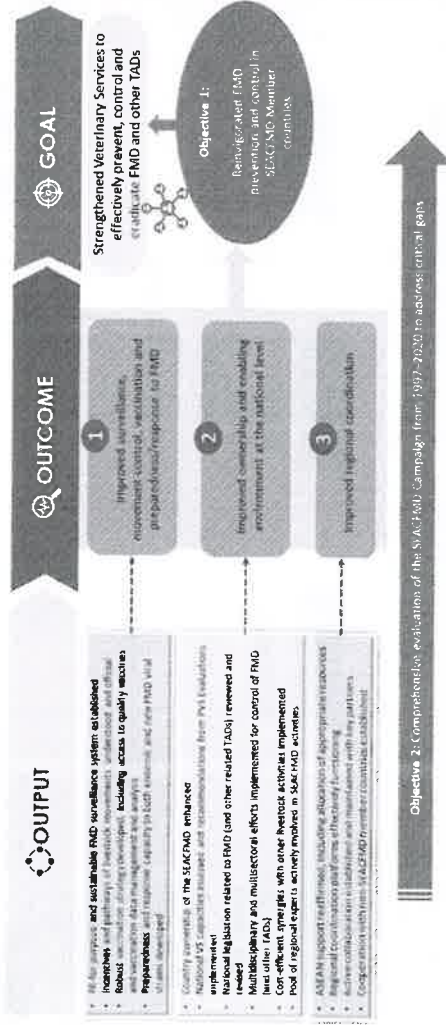


2021 - 2025



Risk-based approach to FMD control





Thank You

Objectives of the 25th SEACFMD National Coordinators Meeting

- Update on the global and regional FMD situation and current FMD epidemiological situation amongst Members.
- Review SEACFMD Campaign progress and follow up on the key actions to implement the recommendations of SEACFMD Governance Meetings.
- Discuss and align the ongoing SEACFMD activities based on the findings and recommendations of the SEACFMD campaign evaluation from 1997 to 2020.
- Discuss the various options to enhance cost-efficient synergies in the control of FMD and other related TADs (ASF, LSD and PPR).
- Provide platform to share experiences and challenges faced by both infected and FMD free countries and countries with free zones and come up with solution to address some of the challenges.

Programme for the 25th SEACFMD National Coordinators Meeting



Outcome 1: Improved surveillance, movement control, vaccination and preparedness/ Response

Regional Study on Animal Price Monitoring

Conduct in depth FMD risk assessment in Johor and Langkawi, Malaysia - Ongoing

Assess emergency Preparedness and Response Capacity by the Members

Study to identify status of Asia 1 in SEA and assess the detection probability of FMDV Asia 1 in SEACFMD region

Animal Price Monitoring Pilot Study in Malaysia - Identify FMD driver – animal movement linked with price and cultural changes

SEACFMD Portal and FMD Situation Dashboard

FMD Situation Dashboard



Routine activities – Publication of Annual SEACFMD Bulletins, application of WOAH standards etc.



Outcome 2: Improved ownership and enabling environment at national level

Aligned National FMD control Plan with the SEACFMD Roadmap 2021-2025

Support and implement PVS Evaluation Mission

National legislation related to FMD reviewed and updated

Socio-economic study in Laos and Myanmar to better understand farmers' and CAHWs reluctance and incentives in FMD reporting

Capacity building programs/ Training – ToT on outbreak investigation, GIS, study design, simulation modelling



Digitization of SEACFMD Communication Materials



Develop digital FMD awareness and advocacy tools

Six Digital Materials – Infographics

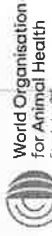
- How to recognise the disease in your cattle or other farm animals
- Action plan to fight against foot and mouth disease outbreaks
- How to avoid buying sick animals
- Biosecurity guidelines for traders
- Sampling for foot and mouth disease diagnosis

<https://tr-asia.woah.org/en/news/new-awareness-communication-materials-on-foot-and-mouth-disease/>



Two Animated Videos

- Safer transport to protect animals from FMD
- How to protect your animals from FMD



Outcome 3: Improved Regional Coordination

Participate in Global Coordination Committee, Global FMD Working Group, WOAH Regional Commission Meetings

Liaised with FAO in the implementation of GF-TADs activities including Regional GF-TADs Steering Committee Meeting in Feb 2023 and development of Regional GF-TADs Strategy for Asia and Pacific (2023 – 2027)

Maintained partnership with Partners, Research Institutions and CC/ RIs.

Maintained cooperation with non SEACFMD Members by inviting them to SEACFMD Meetings

SEACFMD Governance Meetings



SEACFMD Sub-Commission Meeting

Upper Mekong Working Group Meeting

National Coordinators Meeting

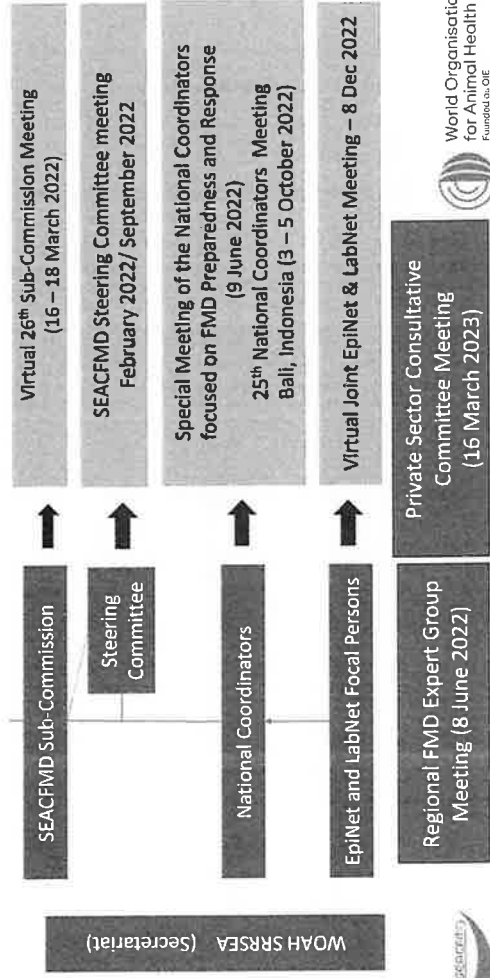
Laboratory / Epidemiology Network Meeting

Regional Export Group Meeting

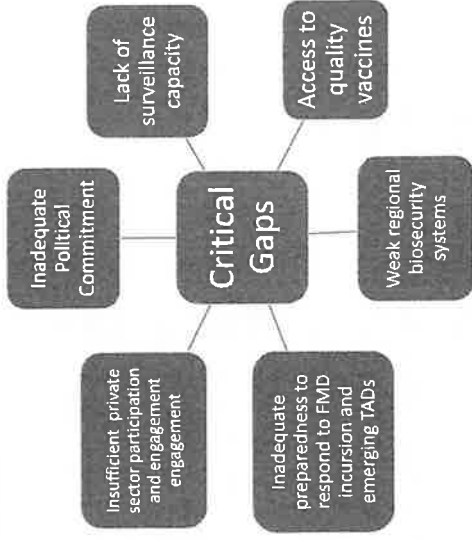
<https://tr-asia.woah.org/en/our-mission/our-mission-regional-strategies/the-south-east-asia-and-china-foot-and-mouth-disease-seacfmd-campaign/>



SEACFMD Governance Meetings



Objective 2: Evaluation of SEACFMD Campaign to address Critical Gaps



Objective 2: Evaluation of SEACFMD Campaign to address Critical Gaps

Introduction: a review assisting 2025 Roadmap
Aim: what's been learned in 23yrs & where to now?

Materials & Methods:

1. Desktop review: Roadmaps, PVS, Lit. etc.
2. Surveys: range of stakeholders
3. Discussion: Global FMD Review team
4. Focus Group Discussions (26th NC Meeting)

Conclusions: Gaps & Recommendations
Consolidate lessons ex history informing future

Improving Biosecurity Change Management



Follow-up on the SEACFMD Governance Meeting Recommendations

26th SEACFMD Sub-Commission Meeting (16 to 18 March 2022)

- Support evaluation of SEACFMD Campaign from 1997 to 2020
 - SEACFMD campaign evaluation successfully completed with support of Members and Partners
- Enhance communication by digitization of FMD communication materials and development of SEACFMD Portal and dashboard.
 - Communication materials digitized – six infographics and 2 animated videos
 - SEACFMD Portal launched on 5 October 2022 during the 25th SEACFMD NC Meeting in Bali, Indonesia

Objective 2: Evaluation of SEACFMD Campaign to address Critical Gaps



Follow-up on the SEACFMD Governance Meeting Recommendations

26th SEACFMD Sub-Commission Meeting (16 to 18 March 2022)

- To work on procedures to validate and declare freedom from Asia 1 serotype from the SEACFMD region.
 - Study to identify status of Asia 1 in SEA – ongoing
- to strengthen epidemiological investigation and management of FMD outbreaks with collection of samples and laboratory diagnosis including virus characterization and ensure closure of outbreak
 - Brainstorming session during the 25th NC Meeting in Bali and Virtual EpizNet/ LabNet Meeting in December 2023
- use modelling for identifying priority areas for vaccination; and CONDUCT anthropological studies on perceptions and behaviour of farmers on vaccination to enhance FMD vaccination.
 - Planned



Follow-up on the SEACFMD Governance Meeting Recommendations

25th SEACFMD National Coordinators Meeting at Bali, Indonesia (2 to 4 October 2022)

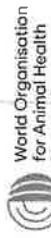
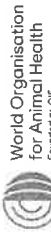
- to implement M&E framework/process to generate consistent data to measure the progress of the SEACFMD campaign at the country level by adapting the M&E framework for the SEACFMD Roadmap 2021–2025, including establishment of baseline and targets for the M&E indicators;
 - Ongoing
- to conduct high level advocacy of the Policy Makers to reaffirm support from highest Authorities on prevention and control of FMD and other related TADs;
 - Development of Policy brief in pipeline
- Advocate priority actions and recommendations through the existing ASEAN mechanism such as ASWGL and SOM-AMAF;
 - SEACFMD Campaign progress and priority actions reported to 31st ASWGL Meeting.



Follow-up on the SEACFMD Governance Meeting Recommendations

25th SEACFMD National Coordinators Meeting at Bali, Indonesia (2 to 4 October 2022)

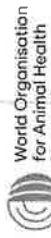
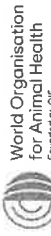
- to explore possibility of setting up of vaccine / antigen bank for the region, to address difficulties in obtaining quality vaccines in the face of emergencies due to supply, regulatory and distributor contractual issues;
 - WOH SRRSEA initiated number of interventions to obtain relevant information
- to promote access to quality FMD vaccines through awareness of the policy makers, streamlining the registration and procurement process and encourage the use of a vaccine compliant with the Chapter 3.1.8. of the *OIE Terrestrial Manual of Diagnostic Tests and Vaccines for Terrestrial Animals*;
 - Policy brief on importance of using quality FMD vaccine in pipeline and different options offered in the Note related to access to quality FMD vaccines and FMD vaccine/ Antigen Bank
- to identify and develop synergies between FMD control and other TADs or other livestock production/health activities;
 - Session planned on Day 3 – Session VIII



Follow-up on the SEACFMD Governance Meeting Recommendations

25th SEACFMD National Coordinators Meeting at Bali, Indonesia (2 to 4 October 2022)

- to enhance early warning, prediction, rapid detection and rapid response to FMD risks and possible incursion;
 - Ongoing Animal price monitoring study, Epidemic Intelligence from Open Source (EIOS) etc
- to map the resources available with different partners through close liaising and collaboration, where possible promote cost sharing so as to maximize impact to the beneficiary countries;
 - Mapping of projects related to TADs in South-East Asia ongoing
- FAO invited to attend the SEACFMD Meetings and share their FMD activities
- To develop and maintain active collaboration between the partners for prevention and control of FMD and other related TADs;
 - Ongoing under GF-TADs umbrella; Regional GF-TADs Strategy developed; and progress of the SEACFMD Campaign and priority actions reported to the 12th Regional Steering Committee for GF-TADs in Asia in February 2023 at Tokyo, Japan



Follow-up on the SEACFMD Governance Meeting Recommendations

Joint Virtual EpiNet/ LabNet Meeting (8 December 2022)

- to conduct a study to identify the critical risk drivers for FMD spread, such as animal movements linked to price changes and cultural festivals.
 - Pilot study on Animal Price Monitoring in Malaysia ongoing
- to conduct a regional study to identify Asia1 status in the region and assess new incursion risks from neighboring regions.
 - Ongoing
- Other recommendations to SEACFMD Members: Optimize surveillance system including strategic sampling for FMDV serotyping; use IEC materials and epidemiological tools (spatial risk assessment using MCDA and cross border risk assessment) developed by WOA;
 - Ongoing
- Other recommendations to WOAH – WOAH in coordination with Ref Lab to provide reference protocols and controls to SEACFMD Members; and use findings of training needs assessment to plan future capacity building programme.
 - Ongoing



➢ Ongoing



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Priority actions identified during the 25th SEACFMD NC Meeting

- Action 2 - Effective communication to relevant target groups

Six Digital Materials – Infographics

- How to recognise the disease in your cattle or other farm animals
- Action plan to fight against foot and mouth disease outbreaks
- How to avoid buying sick animals
- Biosecurity guidelines for traders
- Sampling for foot and mouth disease diagnosis



Two Animated Videos

- Safer transport to protect animals from FMD
- How to protect your animals from FMD

Translation of newly developed materials into local languages is ongoing



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Priority actions identified during the 25th SEACFMD NC Meeting

- Action 1 – High level advocacy to Policy Makers and Decision Makers
 - Policy brief to Policy Makers and decision Makers to reaffirm support from highest Authorities on prevention and control of FMD and other TADs is ongoing
 - Policy brief on importance of using quality FMD vaccine is in pipeline



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Priority actions identified during the 25th SEACFMD NC Meeting

- Action 3 – Improve early reporting and promote transparency

ARAHIS/WAHIS Integration Project:

- Create - ASEAN HUB
- Use the single reporting system

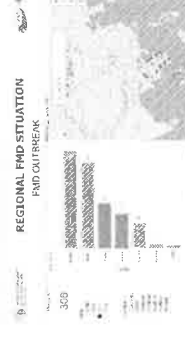


- SEACFMD Portal and FMD situation dashboard

- Recommendations of Joint EpiNet/ LabNet Meeting

- Awareness of owners focused on FMD recognition and reporting
- Strengthen National Animal Disease Information System including immediate reporting to WAHIS/ ARAHIS
- Conduct detail epidemiological investigation of any suspected FMD cases including sampling FMDV serotyping
- Enhance capacity of National Lab to characterize circulating FMDV types

FMD Situation Dashboard



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Priority actions identified during the 25th SEACFMD NC Meeting

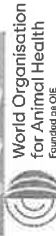
- **Action 4** – Enhance Prediction and early warning Animal Price Monitoring Pilot Study Malaysia
 - To identify FMD risk driver- Animal movements linked with price changes and cultural festivals
 - Collect data on animal and product prices from multiple stakeholders along value chain and predict animal movement patterns in a country and across the border

Supporting Early threat warning/ Intelligence gathering “Asia hub”- Supported by DAFF
Objective: Establish Asia Hub- Active search team for rumour tracking

The training for RR/SRR staff on the use of EIOS (Epidemiology Intelligence Open System) is ongoing.

Recommendations of Joint EpiNet/LabNet Meeting

- Prompt detection and reporting
- Monitoring FMD threats globally and in the region/ epidemiological intelligence and rumour tracking
- Information sharing with neighbouring and trading partners



Priority actions identified during the 25th SEACFMD NC Meeting

- **Action 5** – Explore possibility to set-up Regional FMD Vaccine Bank/ Antigen Bank
- **WOAH has recently drafted Practical Guidelines for National Procurement of Veterinary Vaccines.**

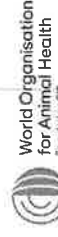
➢ This guidelines have been developed to support WOAH Members in their procurement of quality-assured veterinary vaccines.

- **The European Commission for the control of Foot and Mouth Disease (EuFMD) is currently developing a prequalification scheme for FMD vaccines (PQv)**

➢ Prequalification (PQv) of vaccines is a system to ensure that vaccines supplied to EUFMD meets minimal internationally accepted criteria for quality, safety and efficacy.

➢ PQ is a peer review process by independent experts of information, including existing marketing authorisations/licences/registrations, made available by applicants.

- **For ASEAN Member States, the Mechanism for ASEAN Registration of Animal Vaccine is in place**



Priority actions identified during the 25th SEACFMD NC Meeting

- **Action 4** – Enhance Prediction and early warning Animal Price Monitoring Pilot Study Malaysia

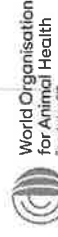
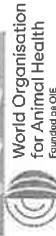
- To identify FMD risk driver- Animal movements linked with price changes and cultural festivals
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Supporting Early threat warning/ Intelligence gathering “Asia hub”- Supported by DAFF
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Recommendations of Joint EpiNet/LabNet Meeting

- Prompt detection and reporting
- Monitoring FMD threats globally and in the region/ epidemiological intelligence and rumour tracking
- Information sharing with neighbouring and trading partners



Priority actions identified during the 25th SEACFMD NC Meeting

- **Action 5** – Explore feasibility to set-up Regional FMD Vaccine Bank/ Antigen Bank

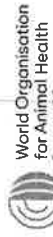
- **WOAH used to manage FMD Vaccine/ Antigen Bank and discontinued in 2020**

➢ WOAH Vaccine Bank benefitted Myanmar, Laos and in lesser quantity Mongolia and Cambodia

- **WOAH SRRSEA met different stakeholders (Manufacturers, PANAFITOSA)**

➢ Several countries, including in Asia, have signed bilateral supply agreements (Antigen or Vaccine Bank) with manufacturers to secure their access to quality FMD vaccines.

➢ In the Americas, a regional/multi country mechanism has been established to provide access to FMD vaccines to the interested countries. The mechanism, called **BANVACO**, will be operational once three countries has signed the Agreement.



Priority actions identified during the 25th SEACFMD NC Meeting

- **Action 5** – Explore possibility to set-up Regional FMD Vaccine Bank/ Antigen Bank
- **Recommendations**

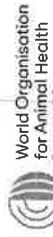
✓ Quality should remain number one criteria in your purchase of FMD vaccines

✓ Compare the vaccines produced nationally with vaccines produced internationally and only select the vaccines which comply with minimum international standards

✓ Read the **WOAH Practical Guidelines for National Procurement of Veterinary Vaccines** when procuring your FMD vaccines

✓ Follow the latest information on the EuFMD prequalification scheme for FMD vaccines which can help you list only high-quality vaccines in future procurement of FMD vaccines

✓ For ASEAN Member States, refer to the ASEAN Vaccine Registration mechanism of animal vaccine when purchasing FMD vaccines



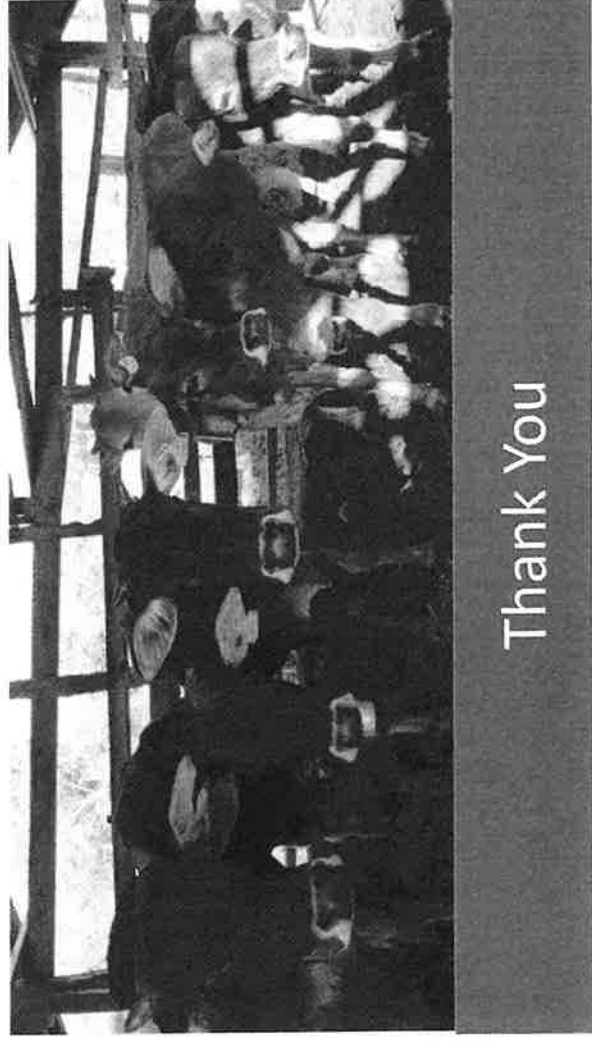
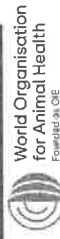
Priority actions identified during the 25th SEACFMD NC Meeting

Action 5 – Explore possibility to set-up Regional FMD Vaccine Bank/ Antigen Bank

Recommendations

- ✓Liaise with relevant manufacturers providing quality FMD vaccines to assess the opportunity to develop a bilateral supply agreement (FMD Vaccine/ Antigen Bank)
- ✓Contact WOAAH in case you would like more information and guidance on FMD supply agreements and FMD vaccine/antigen banks.
- ✓Respond to the questionnaires and requests submitted by the SEACFMD secretariat (FMD Vaccination Reports in particular).

Information and recommendations provided are general, individual FMD situation, needs and expectations of each country to secure its access to FMD quality vaccines differ and may require different solutions. WOAAH remain available to discuss this important question bilaterally with any SEACFMD Members.



Upcoming Activities

- 26th SEACFMD National Coordinators Meeting in Malaysia from 22 – 24 August 2023
- SEACFMD LabNet Meeting in October 2023
- Workshop on safer trade in December 2023
- Upper Mekong Region Working Group Meeting in Feb 2024
- 27th SEACFMD Sub-Commission Meeting in March 2024





Overview of global FMD events

Donald King

FAO World Reference Laboratory for FMD (WRLFMD)
WOAH Reference Laboratory for FMD
The Pirbright Institute

Acknowledgements: Valerie Mioulet, Nick Knowles, Anna Ludi, Britta Wood, Ginette Wilsden, Krupali Parekh, Andrew Shaw, Antonello Di Nardo, Jemma Wadsworth, Clare Browning, Mark Henstock, Hayley Hicks, David Paton, Dexter Wiseman, Jozhel Baguisi, Harry Bull, Amy McCarron, Bryony Armson, Sarah Belgrave, Sarah Belton



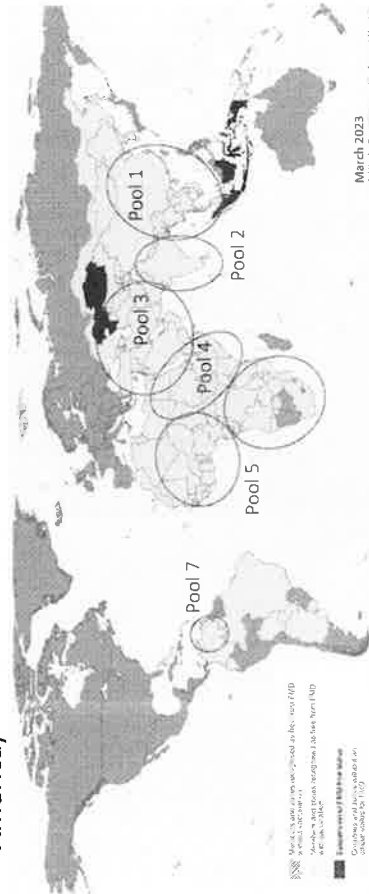
eofmd

World Organisation
for Animal Health
Paris, France
OIE



Global status of FMD

- FMD is endemic in much of Asia and Africa (and parts of South America)



- Seven endemic pools** that maintain specific viral lineages
- Six circulating FMDV serotypes with an unequal distribution
 - Serotype C has not been detected globally since 2004

WOAH/FAO FMD Laboratory Network

www.foot-and-mouth.org



Network Members and affiliates:

Core activities:

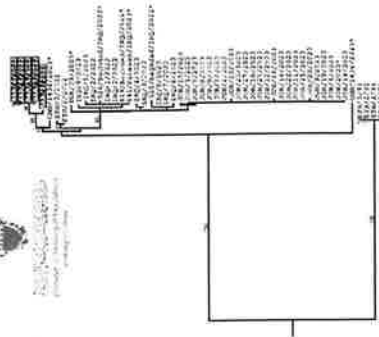
- Collation and exchange of data
- Test improvement and harmonization
- Vaccine performance
- Review of FMD risks
- Support to GF-TADS regional RoadMaps



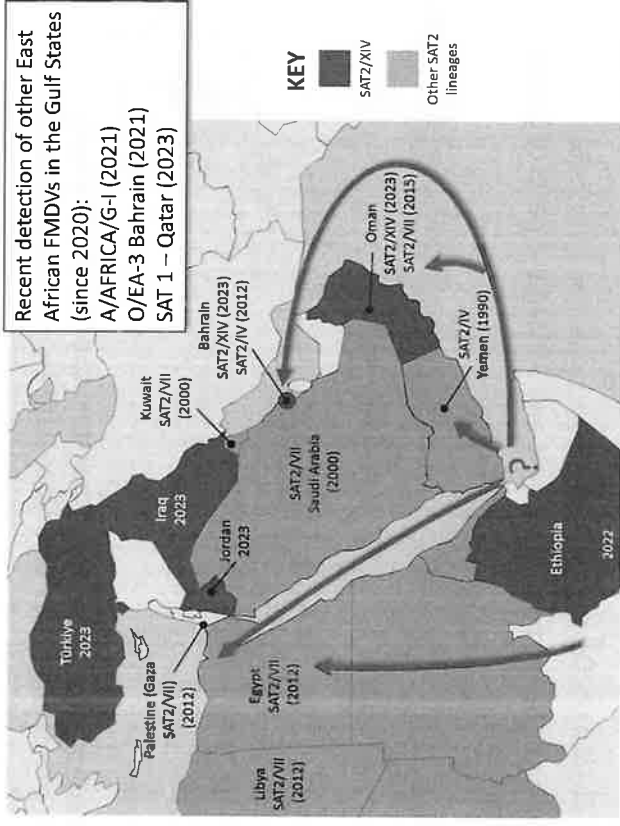
2022 Network Meeting, Lelystad, The Netherlands

New FMD outbreaks due to the SAT2/XIV topology

- VP1 sequence data and samples: kindly shared by colleagues at: Central Veterinary Laboratory and Researches Veterinary Dept, Iraq; FMD (ŞAP) Institute, Türkiye; JUST, Jordan, Central Laboratory of Animal Health, Oman; Sultan Qaboos University, Oman; ANSES, France and AHL, Ethiopia
- Most closely related to sequences recovered from samples collected in SW Ethiopia in 2022
- To our knowledge, this is the first time that serotype SAT 2 has been detected in Iraq, Jordan or Türkiye
- Topotype XIV has been detected on only one other previous occasion – in 1991

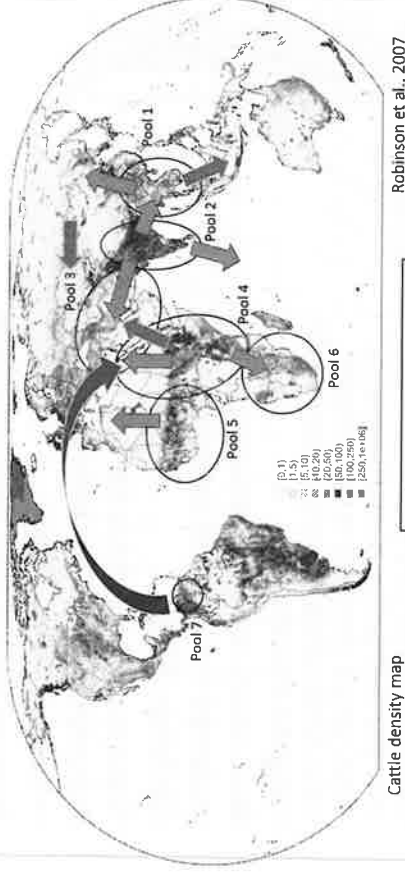


SAT 2 outbreaks in North Africa/Middle East



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Trans-pool movements are important



Long distance (trans-pool) FMDV movements (since 2015)

- Impact/change regional FMD risks including FMD free countries
- Selection of vaccines to control outbreaks

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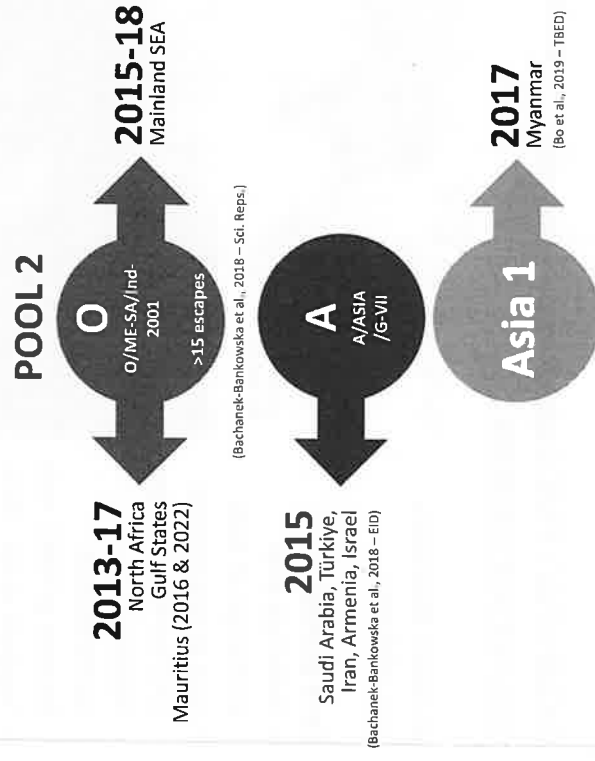
SAT2/XIV – a quickly changing situation

Some points to consider....

1. SAT2/XIV is spreading in naïve animals without any immunity conferred by previous infection/vaccination
2. Reports of mortality associated with SAT2/XIV infection (or secondary infection) and corresponding disease severity particularly in large ruminants (cattle/buffalo) – similar to reports in Egypt in 2012 associated with SAT2/VII outbreaks?
3. Source (and timing) of the virus in the region is currently still being investigated as well as the risk pathways by which SAT2/XIV has been introduced into the region
4. There is uncertainty about the status of neighbouring countries in the region (wrt SAT2/XIV)
5. Opportunities for rapid spread elsewhere in West EurAsia (incl. Caucasus countries, as well as into FMD free regions (such as the Balkans).

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Spread beyond Pool 2 – 10-year historical context



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Conjectured distribution of O/ME-SA/Ind2001e

- O/ME-SA/Ind-2001e is the most widely-spread FMD lineage
- Sequences are heterogeneous in SEA (i.e. multiple genetic clades of this lineage are present)

Data from WOAH/FAO FMD Lab Network:



Data kindly shared by the Malaysian National Foot-and-Mouth Disease Laboratory (MNFMDL)

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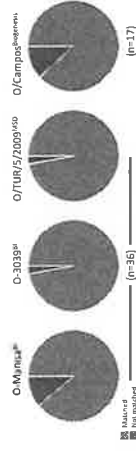
New FMD outbreaks due to O/ME-SA/Ind-2001e

- New outbreaks reported to WOAH in May 2023 affecting cattle (and one goat)
 - Sequences and viruses provided by APOA, South Korea
 - >98% sequence identity to sequences from SEA and Mongolia
-
- O/ME-SA/Ind-2001 cases in China (2017-21) described in a recent paper by Zhang et al., (2023)
 - Sequence variability in an epitope within VP1

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O/ME-SA/Ind-2001e: vaccine matching (2017-2023)

- Vaccine matching data for field isolates from regions where this lineage is present
- Recent vaccine matching data from WRLFMD for an Indonesian/South Korea field isolate supports the selection of these vaccines
- Data supported by *in vivo* studies with O-3039, O-Manisa and combination (Boehringer-Ingelheim)



Samples from PUSVETMA, Indonesia

ISAV/22 evaluate titre	ISAV/22 evaluate titre
O1 Campos, Biogénesis Bagó	0.47, 2.46
O-3039, Boehringer Ingelheim	0.69, 1.76
O Campos, Boehringer Ingelheim	0.20, 1.92
O Manisa, Boehringer Ingelheim	0.54, 2.14
O Panasia 2, Boehringer Ingelheim	0.40, 2.12
O/TUR/15/09, MSD Animal Health	0.50, 2.09

Fishbourne et al., (2017) *Vaccine* 35: 2761-2765
Singanallur et al., (2021) *Vaccines* 9: 1110

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Brewing up the next serotype O virus lineage

- History of pandemic serotype O lineages emerge from Pool 2

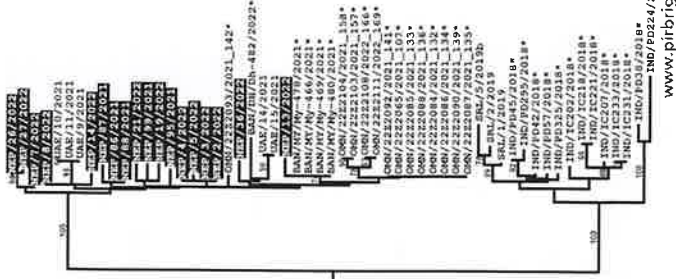


<https://www.thinglink.com/scene/451911993104793602>

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Pool 2/3: O/ME-SA/SA-2018:
an emerging lineage that threatens SEA ?

- New serotype O lineage detected in Pool 2 (India, Nepal, Bangladesh and Sri Lanka)
- Lineage estimated to represent ~ 40% of serotype O cases in India
- Detected in Pool 3 (UAE and Oman) in 2021 in small ruminants
- Scope to spread more widely – following pathways for O/ME-SA/Ind-2001 (d and e)
- Vaccine matching for this lineage appears to be similar to O/ME-SA/Ind-2001e



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Pool 1: Status in 2023
Characterisation of different FMD virus lineages

Based on data from WRLFMD, RRLSEA, the OIE/FAO Lab Network and reported @SEACFMD

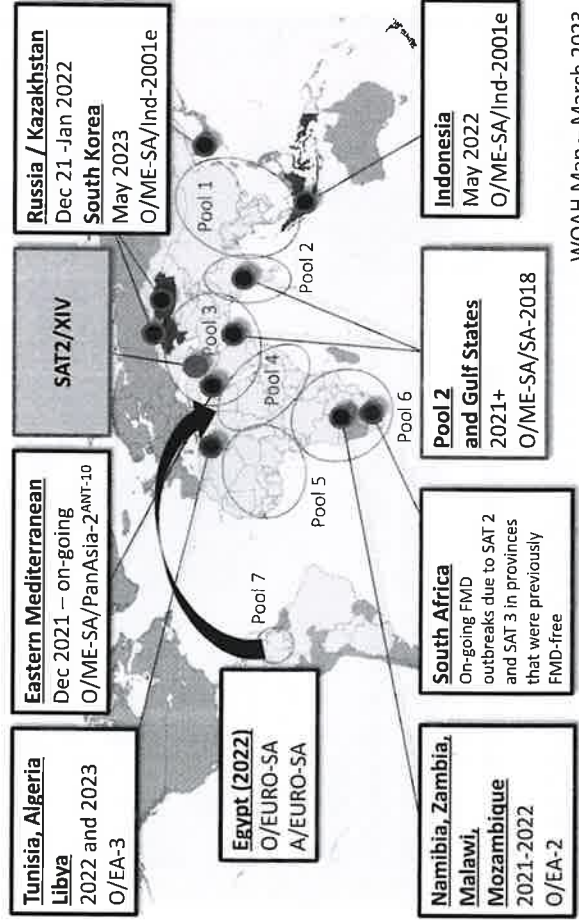


Country	O					A		
	ME-SA/Ind-2001e	SEA/Mya-98	CATHAY	MESA/PanAsia	MESA/PanAsia-2	ASIA/Sea-97	ASIA/Ind	Asia-1
Cambodia	2019	2016	2019	2019	2016			
Laos	2020	2017		2018	2018			
Malaysia	2022	2016	2005	2020	2009			
Myanmar	2021	2021				2010	2017	
Thailand	2021	2018	2012	2019				
Vietnam	2022	2019	2018	2018				2006
PR China	2021	2020	2022	2019				2009
Indonesia	2022			2017				
Mongolia	2022	2018			2016			

Is this the true picture of FMD in SEACFMD countries?

..... or does under-sampling bias our understanding of the epidemiology? www.pirbright.ac.uk

Headline global events (2021/23)



WOAH Map – March 2023

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FMD vaccines

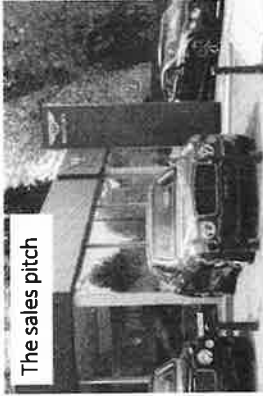
- Which FMD vaccine should I purchase?
 - How can I ensure that it is fit for purpose? (i.e., will it be efficacious for the specific viruses that threaten livestock in my country?)
1. Antigenic match between a field virus and a vaccine strain defined by vaccine matching
 2. Testing of the vaccine in the field can also be very important (SSIS and PVM)



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Why FMD vaccines fail?

- Poor quality vaccine (potency, 146S content)
- Poor antigenic match to the circulating strains
- Failure in the cold chain
- Low coverage in the target population
- Failure to follow recommended vaccination schedules
- Failure to employ complementary control measures



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Establishing “pragmatic” serological cut-offs

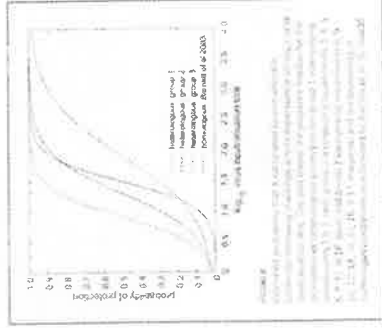
- Vaccine-induced antibody responses correlate to protection
- Testing can be focussed to measure **heterologous responses** (i.e., vaccine to field strain)
- Calibration to ELISA methods is an on-going priority

© Harbiers

Predicting cross-protection against foot-and-mouth disease virus strains by serology after vaccination

Sirion Garibini¹, Ennio J. Pison^{2*}, Aldo Di Felice³, Anna B. Laib⁴, Gabriela W. S. de M. Clara F. J. Broering⁵, Michele Eschbaum⁶, Jamie Barnabee⁷, Hernando Durque⁸, Lisa L. Paulzek⁹, et al. Donald P. King¹

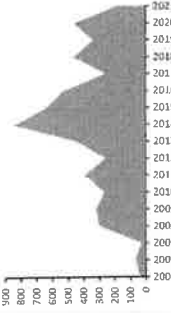
- Day-of-challenge sera (n = 180) from 13 previous FMD cross-protection experiments for serotypes O (n = 2), A (n = 10), and SAT 2 (n = 1)
- Sera retested at WRLFMD



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Talk summary

- Epidemiology of FMD is very dynamic with strong epidemiological connections between Pool 2 and Pool 1
- **Sampling of field outbreaks is critical**
 - Monitor epidemiology and assess impacts of the disease
 - Emergence of new strains
 - Inform vaccine selection and deployment of vaccines



- WRLFMD and the WOAH/FAO Lab Network welcome sample submissions from member states
 - Testing of clinical samples is free of charge
 - Contact: donald.king@pirbright.ac.uk

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Further information.....

- FMD reports and lab testing (<https://www.wrlfmd.org/ref-lab-reports>)
 - Genotyping reports, Vaccine matching and Serotyping reports
- Other data sources:
 - Quarterly WRLFMD/EuFMD report (<https://www.wrlfmd.org/ref-lab-reports>)
 - Annual report of the WOAH/FAO FMD Laboratory Network (<http://foot-and-mouth.org/>)



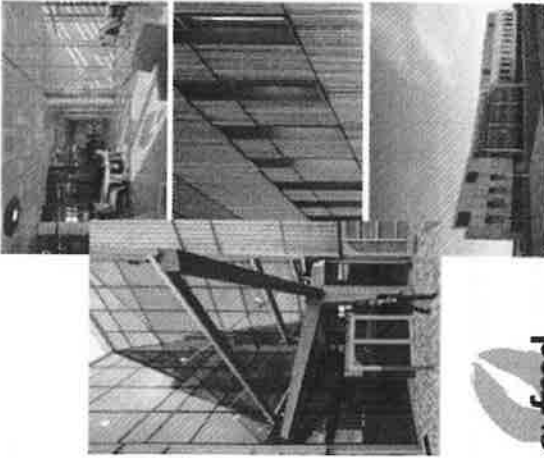
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Acknowledgements

- Collaborating FMD Reference Laboratories and field teams
- Partners within the WOAH/FAO FMD Lab Network
- Support for the WRLFMD and research projects



Department
for Environment
Food & Rural Affairs

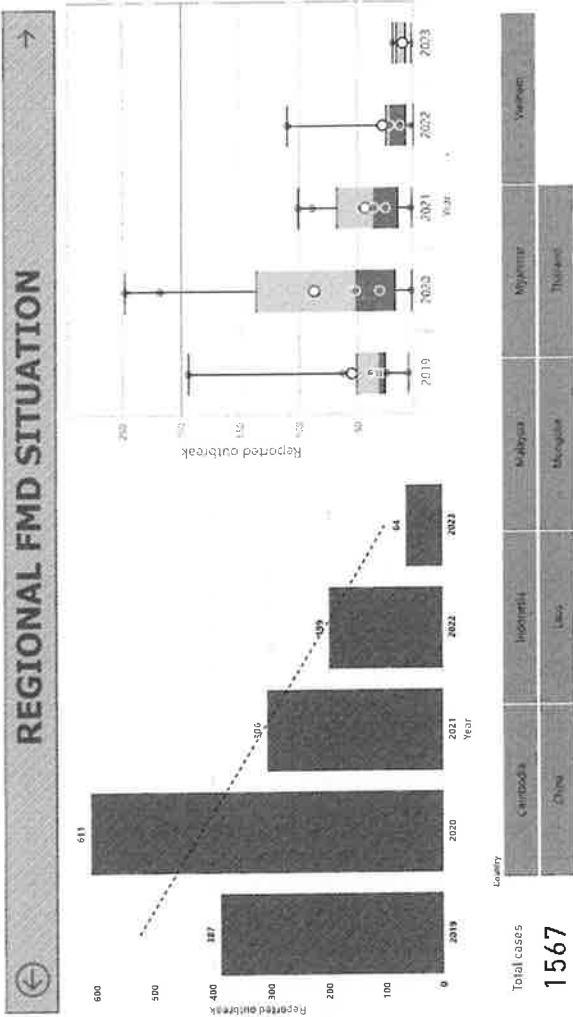


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For the benefit of the world

REGIONAL FMD SITUATION UPDATES

BOLORTUYA, P. WOAH SRR SEA



Source of information and Data analysis

Data source:

- ARAHIS
- WAHIS
- WOAH Reference Laboratory report
- Country reports

Data analysis:

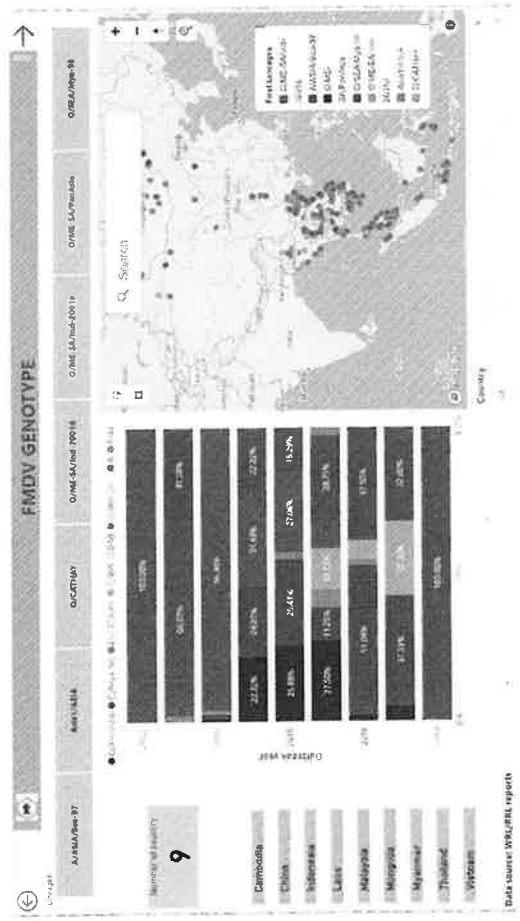
- Regional Ms Excel dataset
- PowerBI

QGIS

Power BI

FMD Situation Dashboard

REGIONAL FMD SITUATION



OBSERVED FINDINGS	DISCUSSION
<p>The trend line shows declined cases - is that a true picture of FMD in the Region?</p> <ul style="list-style-type: none"> Serotype Asia 1 has not been detected in the Region since 2017, with the last recorded case in Myanmar Serotype A has been reported in Thailand consistently with observed clusters from 2014 to 2023 (except 2022) Serotype O/ME-SA/Ind-2007e remains predominant since 2020 (first detection was in 2016) Serotype O/ME-SA/Ind-2007d - 5 countries, between 2015-2017 Serotype O/ME-SA/Pan-Asia - 7 countries, 2015 to 2020. The last case was recorded in Vietnam, Cambodia in 2019 and Malaysia, 2020. 	<ul style="list-style-type: none"> Require full epidemiological investigation Timely reporting - Remains crucial More accurate and detailed data is required Robust surveillance Enhance sample collection/submission to the RRL and WRLFMD Encourage Regional surveillance ASIA 1 study is currently ongoing/Support is needed from member countries
<ul style="list-style-type: none"> Reporting in ARAHIS declined - technical issues faced by both users and admin/ frequent access failure /restoring remains challenging/ outdated/no Backup plan ARAHIS /WAHIS Integration Project Data discrepancies - WAHIS (FMD reports are missing report in 6 monthly report), ARAHIS and country report 	

THANK YOU FOR YOUR ATTENTION

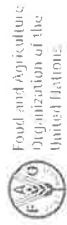
<https://ra.asia.wahis.org/our-mission/our-mission-regional-strategies/the-south-east-asia-and-china-foot-and-mouth-disease-eradication-campaign/>



FMD Situation Dashboard
REGIONAL FMD SITUATION
FMD O-JIRRA



Scan me!

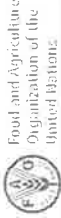


Global FMD Control Strategy

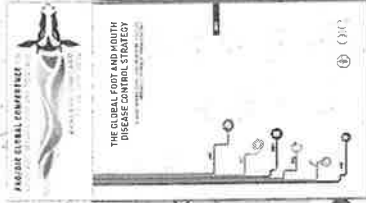
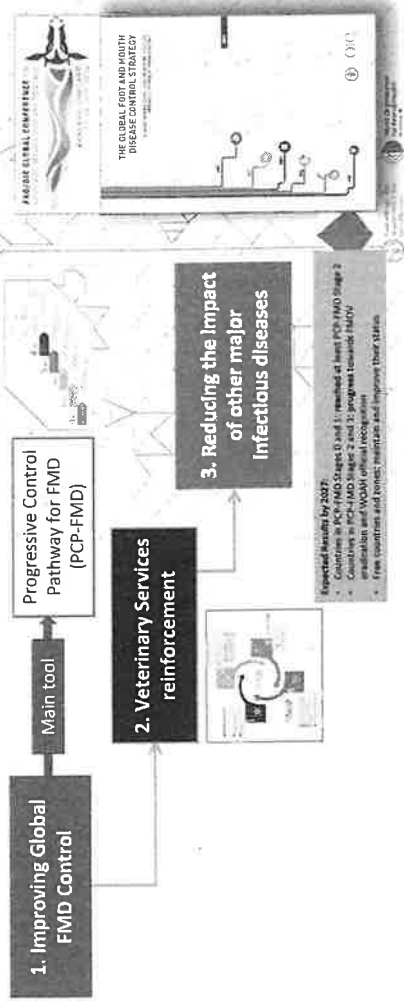
WOAH standards

GF-TADs FMD WG:

Melissa McLaws, Madhur Dhingra, Muhammad Arshad (FAO)
Neo Mapiitse, Bolartuya Purevsuren, Mohamad Sirdar (WOAH)
Fabrizio Rosso (EuFMD)



Global FMD Control Strategy- The three components

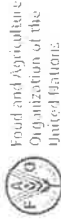


Global Strategy The three components

□ Global FMD control

□ Strengthening of Veterinary Services

□ Prevention and control of other major diseases of livestock



Rationale of the Global Strategy: The three components

□ Global FMD control

- Decrease the impact of FMD in the world by reducing the number of outbreaks and to improve animal health globally
- Maintain production and export capacities and status of free countries
- The focus is in FMD endemic regions – (PCP Stages 0-2)
- Stepwise approach (Progressive Control Pathway (PCP) for sustainability and regional approach
- FMD control is considered a public good





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Rationale of the Global Strategy

Strengthening of Veterinary Services

- Strengthening animal health systems by targeting the Veterinary Services
- Progression in parallel of countries in Stages 0-2 to reach at least Stage 3
- Countries to Stage 3 and above have a robust Veterinary Services (Level 3 FMD relevant PVS CCs) to enable them to at least maintain level of compliance

Veterinary Services and their infrastructure are improved



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FMD control : Main Tools

- SEACFMD Roadmap
- FMD Progressive Control Pathway (PCP-FMD)
- WOAH standards, endorsement of control programmes, and recognition of disease status
- The WOAH PVS Pathway
- Diagnostic Laboratories, FAO/WOAHP Reference Centres, Regional and global networks
- National, regional and international surveillance and epidemiology networks
- SET, LMT, GEMP, GLEWS, PPP



DS



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Rationale of the Global Strategy

Prevention and control of other major diseases of livestock

- Implementing Components 1 and 2 of the Global Strategy will have a positive spill-over effect on the control of other major diseases
- Achieving progress on FMD control and development of VS implies enabling environment for disease control with
 - Better VS infrastructure
 - Enhanced preparedness, prevention and response capacities
- Select diseases according to regional or national priorities

Prevention and control of other major diseases of livestock are improved as a result of the FMD control strategy.



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State of play of the Global Strategy implementation

Milestones: 3 phases of 5 years each from 2012



FMD Roadmap meetings



Global Strategy of the Progressive Control Pathway for Foot and Mouth Disease

Regional Roadmaps
West Eurasia
Middle East
South Asia (SAARC)
Eastern Africa
Southern Africa
West Africa
Central Africa

SEACFMD Governance meetings

Region	Meeting Dates
South Africa	2011-2012
West Africa	2011-2012
Central Africa	2011-2012
West Eurasia	2011-2012
Middle East	2011-2012
South Asia (SAARC)	2011-2012
Eastern Africa	2011-2012
Southern Africa	2011-2012
West Africa	2011-2012
Central Africa	2011-2012

National

PCP-FMD guiding tool

Countries' investment, political will, control plans (FAO, WOA, EuFMD and donor support)

Performance of veterinary services (PVS)

Promotion of success stories and in country support

Regional

Regional roadmap meetings
SEACFMD Governance meetings

Regional laboratory and epidemiology networks
Regional Expert Group

Regional proficiency test panels

Regional collaboration and transparency, including cross border issues

Global

GF-TADS FMD WG
Developed the GS and coordinates its implementation

Global Network:

- GCC
- Network of FAO/WOAH FMD Reference Lab
- Global Expert Group

Development of resource documents

4-5 May 2015

4-5 May 2015



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State of play of the Global Strategy implementation

GF-TADS FMD Working Group

- Established in 2011, initially FAO & WOA; EuFMD joined in 2018;



- Guided by its Terms of Reference and the GF-TADS Management Committee;
- Activities at Global, Regional and National level;
- Meetings:
 - Operations every 2 weeks;
 - Strategic every month

Global	Regional	National
<ul style="list-style-type: none"> GCC-FMD meetings Strengthen global FMD surveillance 	<ul style="list-style-type: none"> FMD Roadmap meetings Regional Advisory Groups FMD Networks (EP and Lab) Develop regional strategies 	<ul style="list-style-type: none"> PCP-FMD toolkit PCP-support officers Review of national control strategy Develop and implement training
Ensure sustainability Communication, Monitoring, and Evaluation		

The Progressive Control Pathway for Foot and Mouth Disease control (PCP-FMD)

Principles, Stage Descriptions and Standards



The Progressive Control Pathway for Foot and Mouth Disease control (PCP-FMD)
Principles, Stage Descriptions and Standards



Progressive Control Pathway for FMD Control (PCP-FMD)

The PCP-FMD is one of the core tools of the Global FMD Control Strategy, along with the WOAHP Performance of Veterinary Services Pathway (PVS)



The Progressive Control Pathway for Foot-and Mouth Disease (PCP-FMD) is a stepwise approach to control FMD based on a thorough understanding of the routes of transmission and the impacts of FMD


Progressively reduce FMD impact and control disease

A working tool of the control Program
A set of FMD control activities

Each stage:

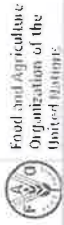
- Objective of stage
- Number of defined outcomes
- Guidance to move to the next stage

Stage	Stage focus
Stage 1	Understand the epidemiology of FMD and develop a risk-based approach
Stage 2	Risk-based measures are implemented and monitored to reduce the impact of FMD in at least one zone or husbandry sector
Stage 3	Early detection and quick response to reduce outbreak incidence and virus circulation in at least one zone of the country
Stage 4	The approved Official Control Programme is implemented and monitored
Status	WOAH free status with vaccination
Status	WOAH free status without vaccination



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TO PROGRESS TO UPPER STAGES
0 → 1: Design a Risk Assessment Plan
1 → 2: Design a Risk Based Strategic Plan
2 → 3: Design an Official Control Programme aiming at virus elimination
3 → 4: WOAHP endorsement of the Official Control Programme

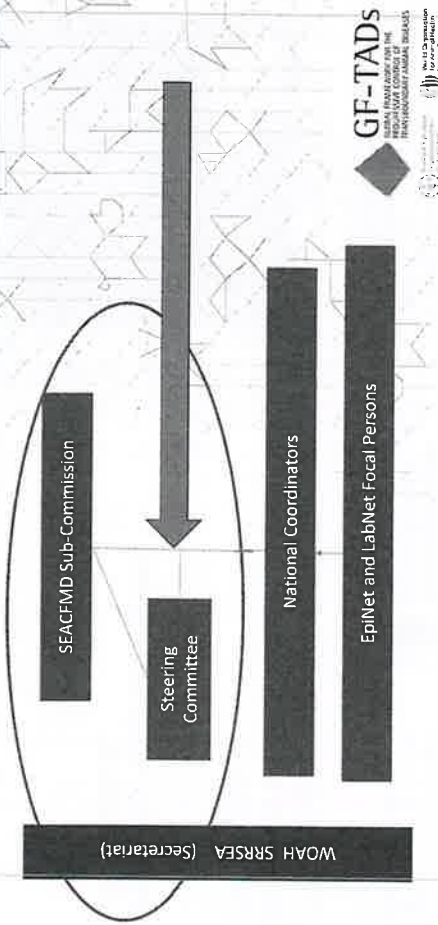


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Acceptance process for countries in PCP-FMD Stages from 0 to 3 (SEACFMD)



GLOBAL FOOT-AND MOUTH DISEASE CONTROL STRATEGY
TRANSNATIONAL COORDINATION
FOR TECHNICAL ASSISTANCE

SEACFMD PCP STATUS



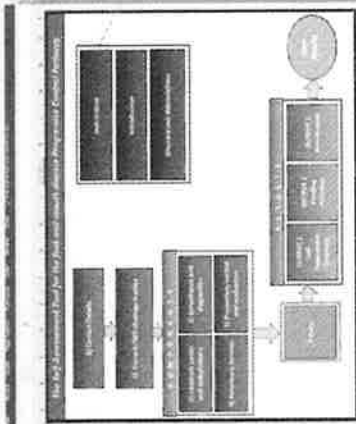
Country	PCP stage
Brunei	Free from FMD
Singapore	Free from FMD
Philippines	Free from FMD
Malaysia	Free from FMD
Sabah, Sarawak	Free from FMD
China	4
Thailand	4
Malaysia (Peninsular)	3
Vietnam	3
Laos	2
Myanmar	2
Cambodia	1
Mongolia	1
Indonesia	1
	OSP Withdrawn
	Supplanted

PCP-FMD Self-Assessment Tool (SAT)

PCP-FMD Stage 0 to 3 in regularly assessing their progress along the PCP-FMD.

- User friendly – the excel-based SAT

- SAT aims to assist countries to identify completed and pending activities that should be carried out (prioritization) to better understand the FMDV situation and better control FMD. It produces detailed outputs/visuals to guide and facilitate the communication with the relevant decision-makers.



<http://www.ahimj.org/ahimj/article/view/1154>, <http://www.ahimj.org/ahimj/article/view/1154>

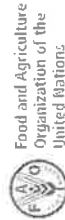
17

WOAH DOMAIN: <https://www.woah.org/en/home/>

Resources about the PCP-FMD

PCP documents available on :

- <https://www.gf-tads.org/fmd/fmd/en/>
- PCP-FMD guidelines
- Templates for FMD Control plans (RAP, RBSP, OCP)
- Self-Assessment tool



THANK YOU



Publishing the SEACFMD toolbox soon.

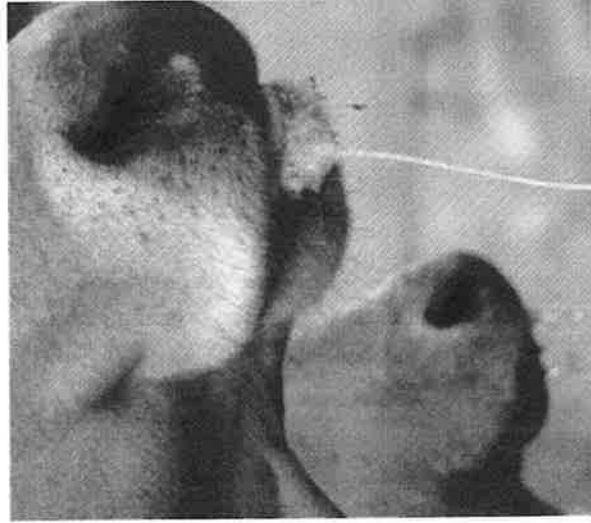
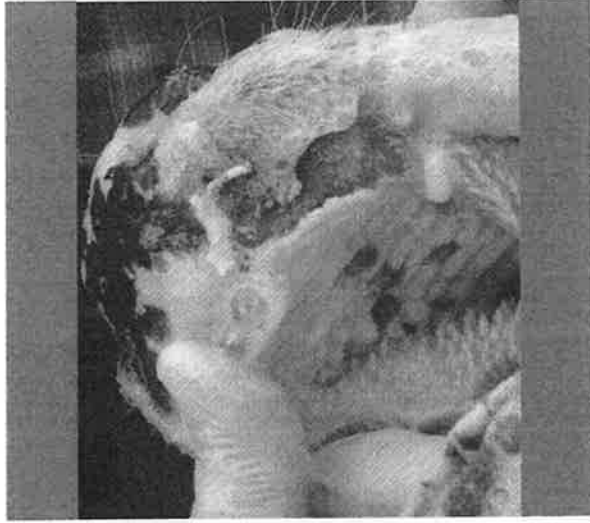




Activities at the Australian Centre for Disease Preparedness to assist with FMD preparedness and response

Wilina Vosloo | 23 August 2023

Australian National Science Agency



FMD preparedness

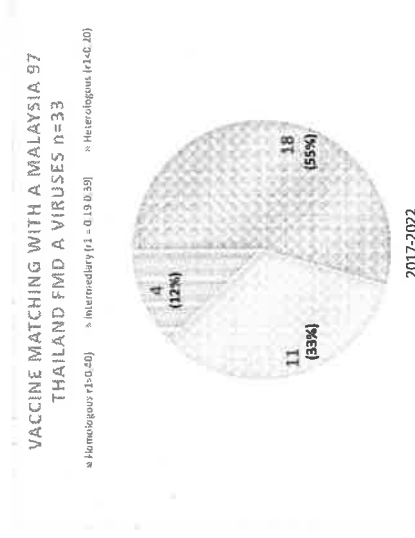
- Tools to assist with
- Surveillance
- Diagnostics
- Control



Laboratory predictions of vaccine efficacy

- *In vitro* screening allows investigations into a large number of isolates
- Vaccine matching using VNT and ELISA (AVB vaccine strains)
- Up to 2018
- Serotype O: no clear trend in antigenic drift
- Serotype A: new viral clusters constantly evolving

Vaccine strain	Serotype O		Serotype A	
	O1/Malaysia	O3039	A22/IRQ	A/MAY/97
No of Isolates	166	1489	60	130
Homologous	32%	72%	28%	75%
Intermediate	13%	12%	25%	8%
Heterologous	21%	1%	42%	15%
Poor binding*	34%	15%	5%	2%



Acknowledgement: Pakchong laboratory in Thailand

Novel way of phylogenetic analysis

- Most phylogenetic comparisons require sequence alignment
 - Prior knowledge on sequence – indels
 - Can be computationally demanding
- K-mer analysis requires no sequence alignment – therefore no prior knowledge

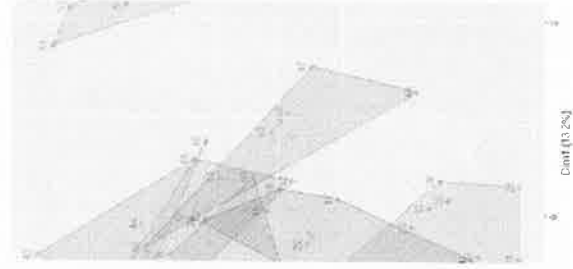


Results

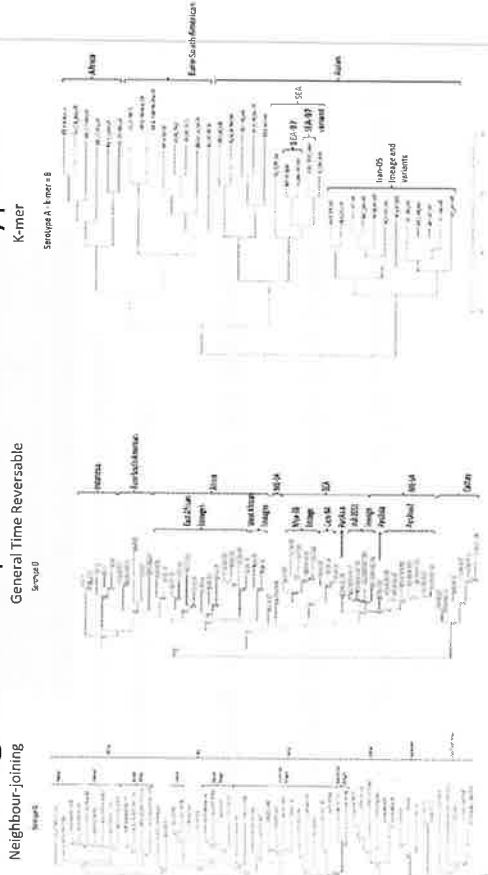
- Genetic groupings were similar between all 3 methods for both serotypes
- However, k-mer analysis was computationally intense and needed high-performance computing systems when large numbers of isolates were compared
- Could improve scripts to circumvent this
- Reference sequences were very useful where alignment is required

Approach

- Downloaded a large number of sequences + internally generated
- Focused on serotype O and A
- Determined the optimal k-mer frequency
- Compared tree topologies generated by Neighbour-Joining, General Time Reversible (GTR) model, and k-mer

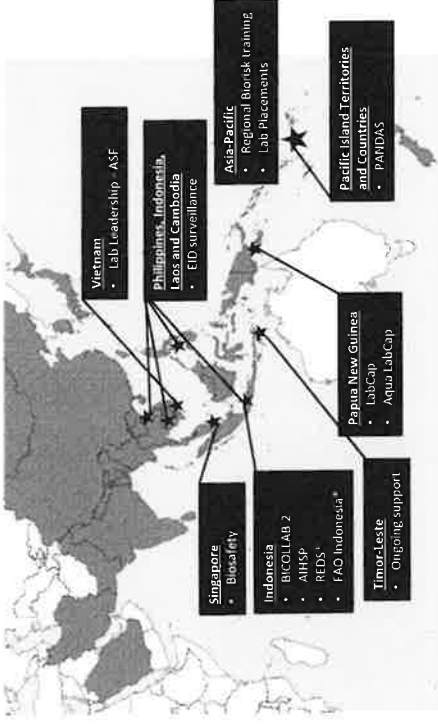


Dendrogram comparisons for serotype O



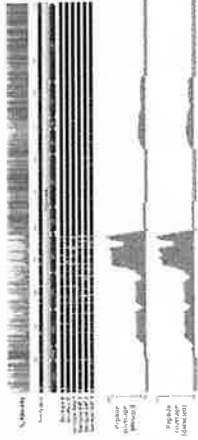


ACDP-IP Regional footprint 2024



Multiplexed profiling of serological responses

- Phage Immunoprecipitation Sequencing (PhIP-Seq)
 - Based on peptide phage display
 - Attractive for high-throughput serological profiling and epitope discovery
 - Sero-epidemiology, risk factor analysis and association, vaccinology and pandemic preparedness efforts
- We investigated if we can distinguish between 5 serotypes and vaccinated animals
 - Pool of 1663 peptides
- Promise for epitope mapping
- Differences between vaccinated and unvaccinated animals
- More value in highly multiplexed assay design

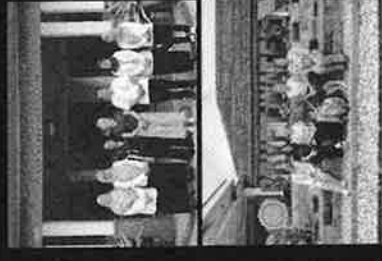


Support for the region through the International Program at ACDP



Achievements: Regional Emerging Disease Support REDS

- DAFF funded project to strengthen technical capability in FMD and LSD
- Assisting lead Indonesian laboratories to develop external quality assurance (EQA) programs for the Indonesian veterinary laboratory network
 - PUSVETMA for FMD
 - DIC Wates for LSD
- EQA consisting of network quality controls and proficiency testing programs for serology and PCR





Achievements: BICOLLAB

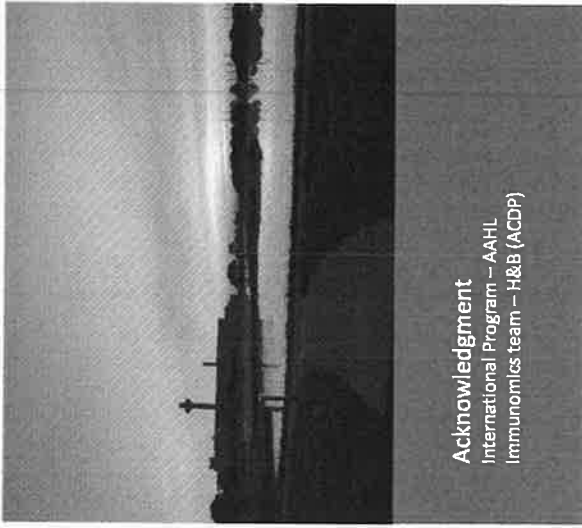
- CSIRO ACDP supports the delivery of a targeted laboratory capacity building project in Indonesia: BICOLLAB
- This project is funded by DFAT's Global Health Division (GHD).
- Sub-project to Evaluate the performance characteristics of LFDs for FMD detection in field conditions was proposed.
- Sub-project objectives
 1. Identify LFDs suitable for antigen detection in FMD outbreaks
 2. Evaluate the LFDs for their performance characteristics
 3. Standardize methods to recover the FMDV genome from LFDs



Thank you

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Australian National Science Agency



Acknowledgment
 International Program – AAHL
 Immunomics team – H&B (ACDP)



Achievements: LabCap PNG

- Laboratory capacity building project in Papua New Guinea
- Funded by the Australian High Commission in Port Moresby
- Strengthening laboratory and field diagnostic capability for priority diseases, including FMD.
- For detection of FMD we have implemented:
 - Real time PCR testing
 - Lateral flow devices
 - ELISA testing (set-up in progress)



NAQIA/DAFF/ACDP - FMD and LSD Preparedness Workshop, Lee, Papua New Guinea, 5-8 June 2023





26th SEACFMD National Coordinators Meeting

Investigation of innate immune evasion by foot-and-mouth disease virus and its application

Dr. Zixiang Zhu

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LANZHOU VETERINARY RESEARCH INSTITUTE,
CHINESE ACADEMY OF AGRICULTURAL SCIENCES

FMDV: Background

- Foot and mouth disease (FMD) is a severe, highly contagious viral disease of livestock that has a significant economic impact.
- FMD is endemic in several parts of Asia and in most of Africa and the Middle East. In Latin America, the majority of countries apply zoning and are recognised as FMD-free, either with or without vaccination.



2001 UK FMD



2010 Japan FMD



2017 Jordan FMD

Outlines of prevention and control of FMD

Vaccination

Restriction of animal and animal products movement

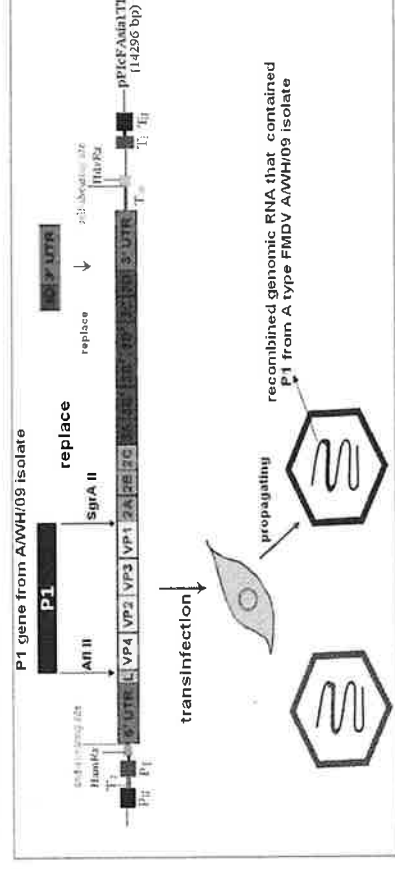
slaughter of infected or suspected infected animals

Measures

Serological and etiological surveillance.

Compulsively inoculated with vaccine combined with slaughtering in China

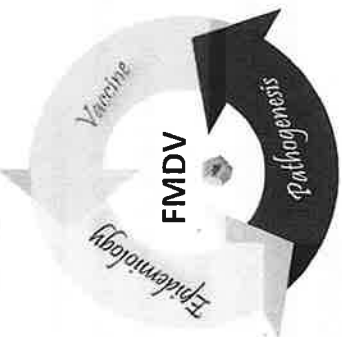
Deletion or modification of the immunosuppressive sites or domains in viral proteins is a prominent strategy to develop FMDV vaccine strain



FMD Etiology and Immunity Team



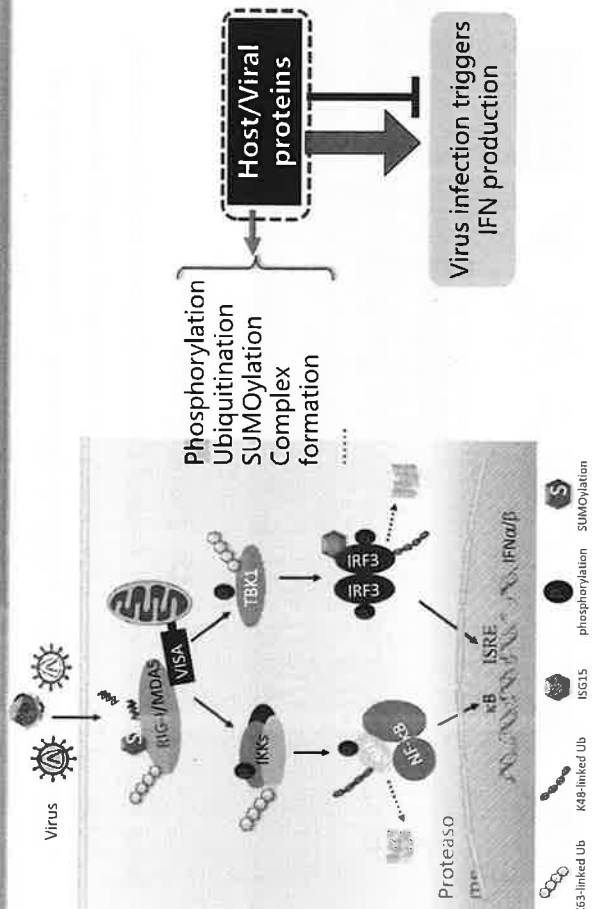
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- Epidemiology**
 - FMD virus (FMDV) Isolation
 - FMDV evolution and distribution study
 - Identifying risk factors for FMD
 - Pathogenic mechanism**
 - Host tropism of FMDV
 - The virulence and antigenic variation of FMDV
 - The suppressive role of FMDV on host immune system
 - Establishment of vaccine development platform**
 - Vaccine development
 - Vaccine process development and manufacture
- FMD vaccines have been developed:*
- FMD O/May-98 inactivated vaccine
 - FMD O-Asia1-A trivalent inactivated vaccine
 - FMD DNA vaccine

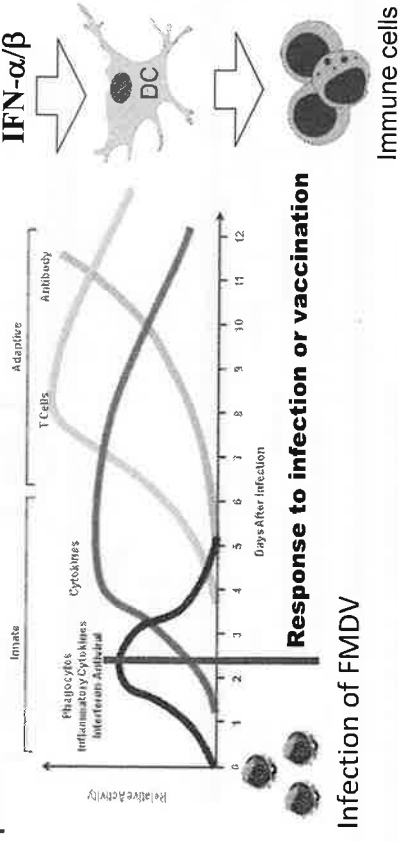
Two of the developed Vaccines were recommended by WOAH/FAO for FMD control.

Innate immune pathways are critical for induction of host antiviral response during viral infection



The mechanisms used by FMDV to antagonize host innate immune response are complicated

Innate immune response is critical for initiation of adaptive immune response



Response to infection or vaccination

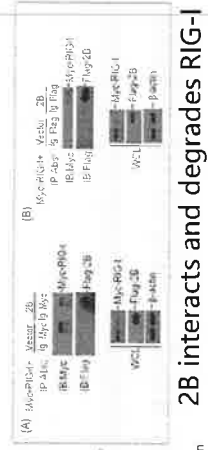
Infection of FMDV

Clarification of the antagonistic mechanisms will provide insights and direction for FMD control

Adaptive immune response

1. Regulation of pattern-recognition receptors (PRRs) by FMDV

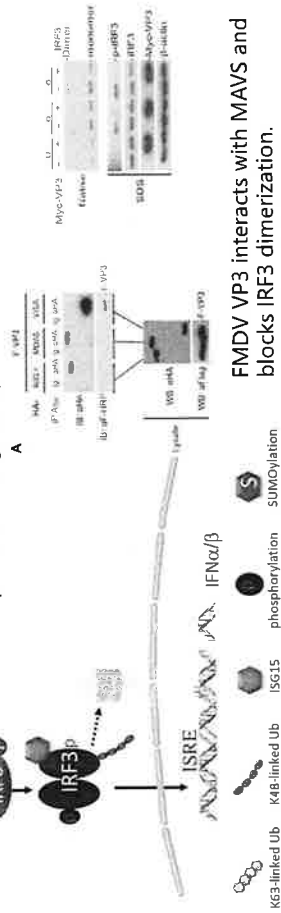
- FMDV 2B and 3B proteins interact with RIG-I to degrade RIG-I and promote FMDV replication (*J Virol* 2016; *J Immunol* 2020).
- FMDV 2B interacts with LGP2 to degrade LGP2 (*Cell Death Dis* 2017).
- FMDV 2B and 2C degrade NOD2 to block innate immune response (*J Virol* 2019).
- FMDV 2C degrades cGAS through autophagy pathway (*PLoS Pathog* 2023)



2B interacts and degrades RIG-I

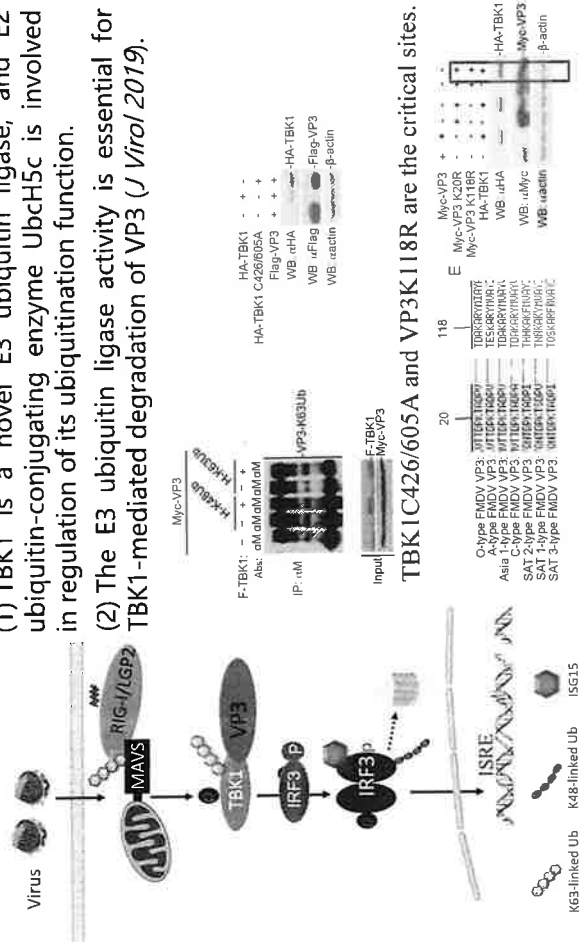
2. Regulation of adaptor protein MAVS by FMDV

- (1) FMDV VP3 interacts with MAVS and interferes with the formation of MAVS complex, blocking type I IFNs production (*FASEB J 2016*).
- (2) FMDV VP0 interacts with PCBP2 to degrade MAVS through autophagy-dependent pathway (*Cell Death Dis 2019*).
- (3) Thioredoxin 2 (TRX2) disrupts MAVS complex formation (*J Virol 2020*).
- (4) FMDV VP1 interacts with IRF3 to block IFNs production (*PLoS Pathog 2021*)



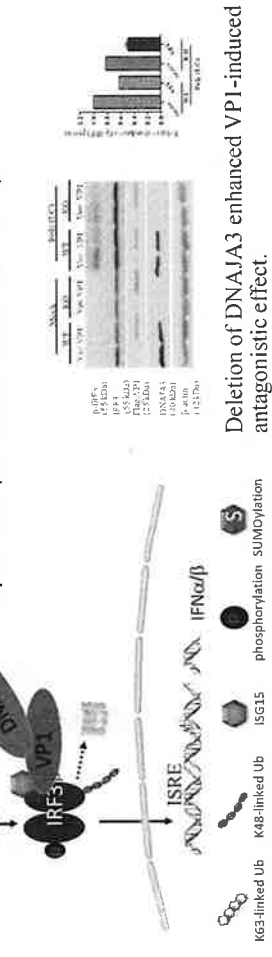
3. Regulation of adaptor protein TBK1 by FMDV

- (1) TBK1 is a novel E3 ubiquitin ligase, and E2 ubiquitin-conjugating enzyme UbcH5c is involved in regulation of its ubiquitination function.
- (2) The E3 ubiquitin ligase activity is essential for TBK1-mediated degradation of VP3 (*J Virol 2019*).



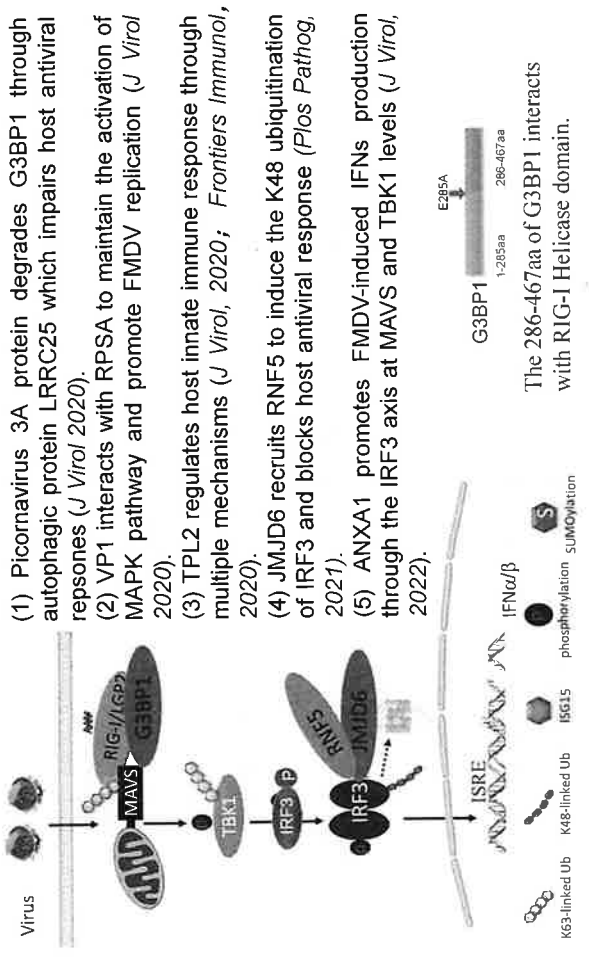
4. Regulation of transcription factor IRF3 by FMDV

- (1) FMDV VP1 interacts with IRF3 and inhibits its phosphorylation and nuclear translocation. Host DNAJA3 degrades VP1 through the autophagy to impair this antagonistic effect induced by VP1 (*J Virol 2019, Cover Story*).
- (2) Foot-and-mouth disease virus capsid protein VP1 antagonizes TPL2-mediated activation of the IRF3/IFN- β signaling pathway to facilitate the virus replication (*Frontiers Immunol, 2021*).

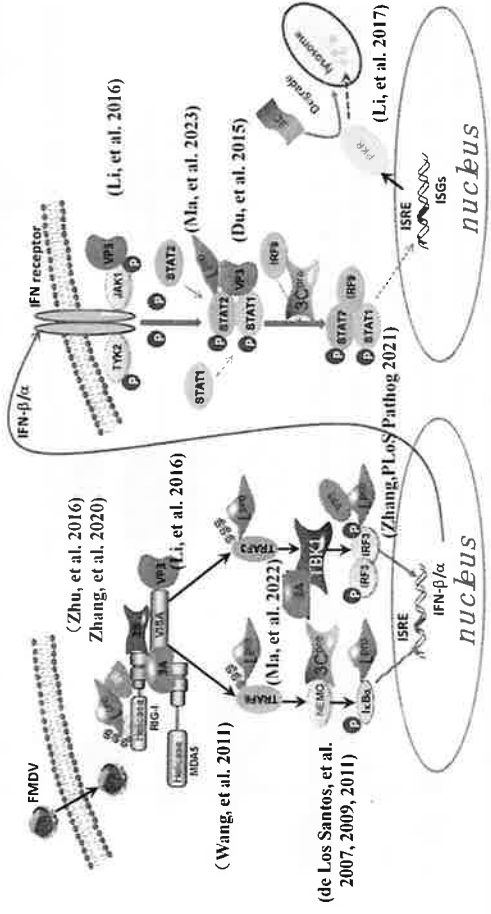


5. Regulation of antiviral response by host proteins

- (1) Picornavirus 3A protein degrades G3BP1 through autophagic protein LRRC25 which impairs host antiviral responses (*J Virol 2020*).
- (2) VP1 interacts with RPSA to maintain the activation of MAPK pathway and promote FMDV replication (*J Virol 2020*).
- (3) TPL2 regulates host innate immune response through multiple mechanisms (*J Virol, 2020; Frontiers Immunol, 2020*).
- (4) JMJD6 recruits RNF5 to induce the K48 ubiquitination of IRF3 and blocks host antiviral response (*Plos Pathog, 2021*).
- (5) ANXA1 promotes FMDV-induced IFNs production through the IRF3 axis at MAVS and TBK1 levels (*J Virol, 2022*).



6. Schematic representation of the antagonistic mechanisms used by FMDV



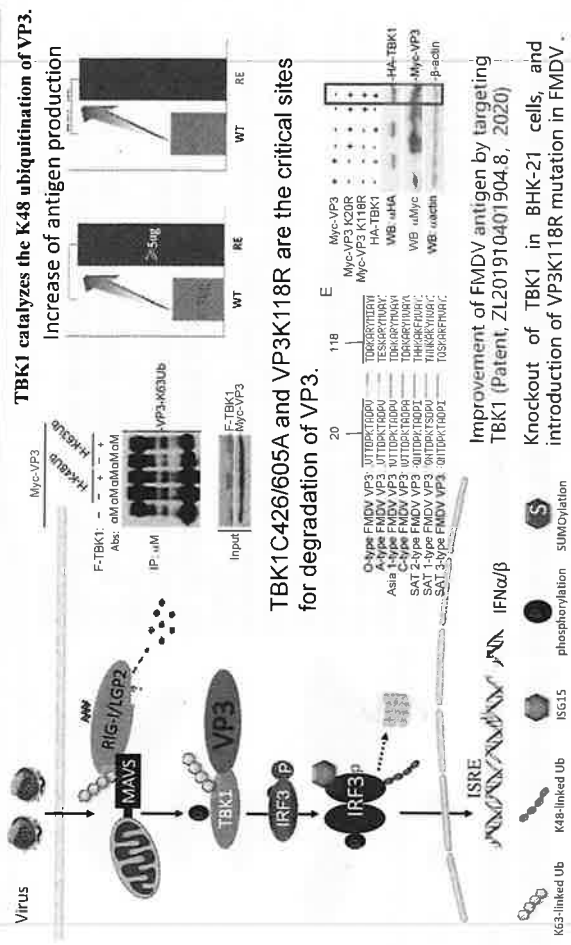
The multiple mechanisms of immune suppression used by FMDV.

Application

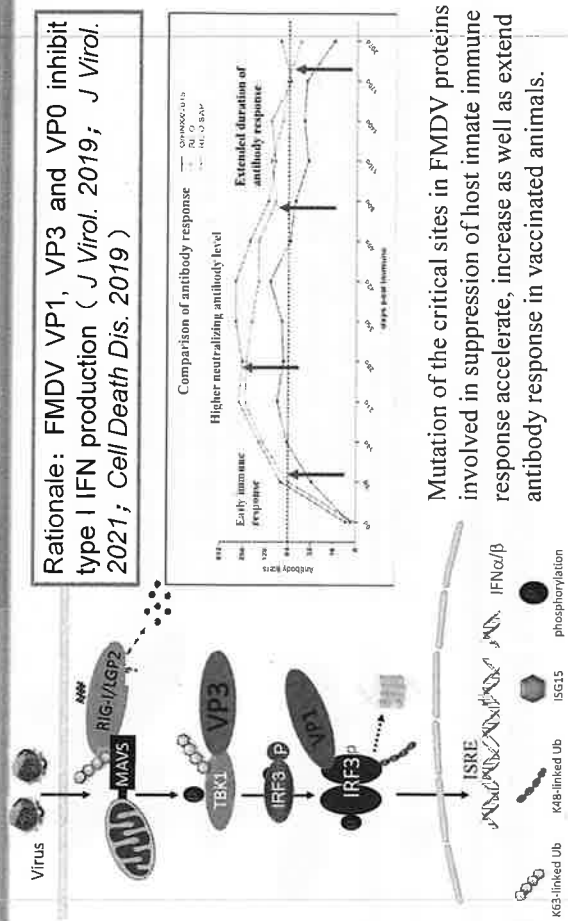
Improvement of vaccine production, safety and efficacy



1. TBK1 degrades VP3 which decreases the antigen level during vaccine production



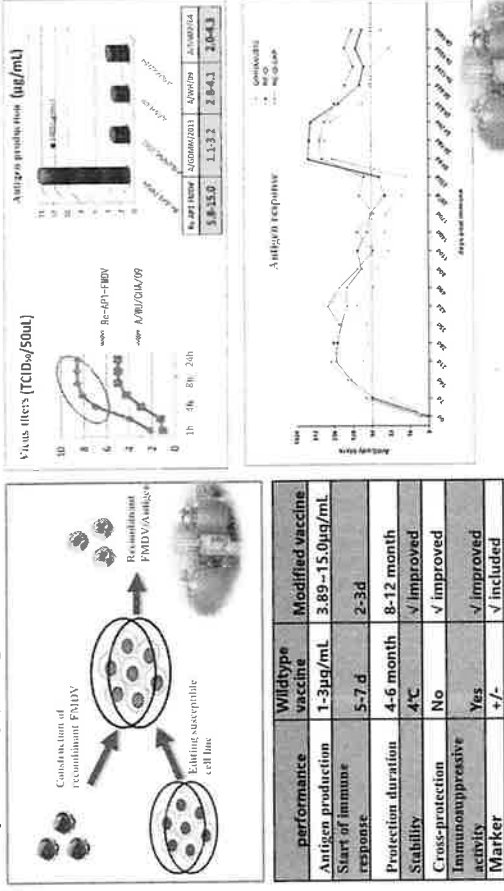
2. Deletion or modification of the immunosuppressive sites in structural proteins to improve the efficacy of FMDV vaccine



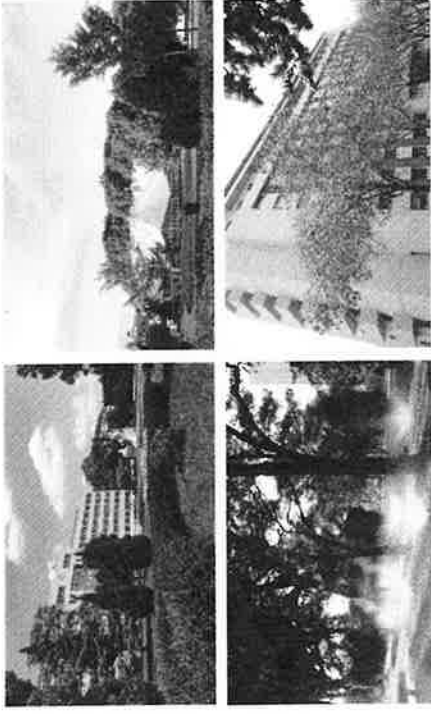
Mutation of the critical sites in FMDV proteins involved in suppression of host innate immune response accelerate, increase as well as extend antibody response in vaccinated animals.

3. Improvement of vaccine performance based on the mechanisms used by FMDV

Producing high-quality vaccines with the performance of high production rates, increased immune efficacy, and improved safety. (Editing virus and cells)



Thanks for your attention!



Lanzhou Veterinary Research Institute

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Lanzhou Veterinary Research Institute

SKL

STATE KEYLABORATORY OF VETERINARY ESTERILIZATION TECHNOLOGY

The Pirbright Institute

World Organisation for Animal Health
Founded as OIE



26th SEACFMD National Coordinators Meeting 22 – 24 August 2023, Kuala Lumpur, Malaysia

RRLFMD Update Activity

Nalinee Hongchumpon, DVM

Regional Reference Laboratory for FMD in South East Asia (RRL)

NIAH, DLD, Pakchong, Nakhonratchasima, THAILAND

❖ IMPROVEMENT ACITIVITY

Human Resources

- Regularly Training
 - Online
 - Onsite
 - PhD Study
- FMDV Diagnosis Workshop
- Refresh Training for national lab
- Evaluation from Experts Team

Building Facility

- Training Building center: Finished
- BSL3 facility: Ongoing
- Follow up & Evaluation

❖ MAIN ACTIVITY

FMD Diagnosis

Antigen Detection

- ELISA serotyping
- Virus isolation
- PCR serotyping

Antibody Detection

- LPB ELISA
- NSP Test
- SN Test

Strain characterization

- Sequencing
- Vaccine matching

Reagent production for ELISA

Rb trapping Ab

GP Anti-FMDV Ab

Inac. Antigen FMD

Mab FMD (Ongoing)

ISO 17025:2017

Proficiency Testing

- PT Provider for National lab
- Participating FMD PT Program organized by WRL

☐ Human Resources : Regularly Biosafety Training



☐ Human Resources : Regularly Diagnosis Training



☐ Human Resources : Evaluation Mission from Experts Team



☐ Building Facility

- ☐ Training Building
- ☐ BSL3 facility



Follow up & DTRA-MORU Evaluation



❖ Research & Collaboration

- ✓ SATREPS, JICA, JAPAN
- ✓ ACDP, AUSTRALIA
- ✓ KODIARA Lab; NIAH, JAPAN
- ✓ ARDA, Thailand
- ✓ WOH
- ✓ WRL

❖ Research & Collaboration

- ✓ Comparison of sensitivity and specificity in six commercial Foot and Mouth Disease Virus non-structural protein ELISA kits in Thailand (Finished)
- ✓ Antigenicity comparison of FMD serotype O vaccine strain against foot-and-mouth disease virus from the O/ME-SA/Ind2001 lineage circulating viruses in Thailand (Ongoing publication)
- ✓ Establishment of Monoclonal antibody for FMDV for reagent development (Ongoing process)
- ✓ Real Time PCR specific Serotype:SSRT-qPCR and Vaccine Matching Study (ACDP; Ongoing process)
- ✓ Collaboration with MORU to develop C-ELISA (Ongoing process, Setting up Training in the future)
- ✓ Develop the Multiplex real time RT-PCR for FMD field strain in Thailand (Ongoing process)

❖ Research & Collaboration

- SATREPS, JICA, JAPAN

▪ Subproject 1

- Development of diagnostic system for livestock infectious diseases : Sub1-a; Foot and Mouth Disease and Similar vesicular diseases



❖ Research & Collaboration

- KODIARA Lab; NIAH, JAPAN
- ✓ 4th Scientific Meeting and Workshop on Foot-and-Mouth Disease
- ✓ Research project: Investigation study on persistent infection circumstances of foot-and-mouth disease virus in cattle in Thailand (On going to submit ARDA)



❖ Research & Collaboration

- ACDP, AUSTRALIA
- ✓ Real Time PCR specific Serotype : SSRT-qPCR and Vaccine Matching Study
- ✓ Next step→ Verify→ Transfer → Training



REGIONAL REFERENCE LABORATORY FOR FOOT AND MOUTH DISEASE IN SOUTH EAST ASIA (RRL)



RESEARCH

□ Introduction

- ✓ Currently, various NSP-ELISA kits capable of detecting antibodies to FMDV are available in Thailand.
- ✓ Therefore, it is necessary to test the efficiency of the appropriated NSP-ELISA kit on various animal sera within the country.
- ✓ There should be a study on the sensitivity and specificity of the NSP-ELISA kit.



□ Comparison of sensitivity and specificity of commercial ELISA kits available in Thailand for detecting antibodies to non-structural proteins of foot and mouth disease virus

K.B. Seeoyo ^{(1)*}, A. Choornasard ⁽¹⁾, J. Chottikamporn ⁽¹⁾, S. Singkleebut ⁽¹⁾, P. Ngamsomsak⁽¹⁾, K. Suanpat⁽²⁾, N. Singanallur⁽³⁾, W. Vosloo⁽³⁾, K. Fukaj⁽⁴⁾

- (1) Regional Reference Laboratory for Foot and Mouth Disease in South East Asia, 1213/1 Moo 11, Pakchong, Nakhon Ratchasima 30130, Thailand
- (2) Bureau of Veterinary Biologics, 1213 Pakchong, Nakhon Ratchasima, 30130, Thailand
- (3) CSIRO-Australian Animal Health Laboratory
- (4) Kodaira Research Station, National Institute of Animal Health, National Agriculture and Food Research Organization, Japan

□ Materials and Methods

- Serum sample
- Positive serum samples : 400 samples
 - Negative serum samples : 400 samples



Six NSP-ELISA kits

- Biovet Foot-and-Mouth Disease Virus Antibody Test Kit, ELISA FMDV NSP-3Bb ELISA (multi-species)
- ID Screen FMD NSP Competition
- VDPPro FMDV NSP AB ELISA
- IDEXX Foot-and-Mouth-Disease FMD, Multispecies Antibody Test Kit
- PrioCHECK FMDV NS
- KUcheck-F FMDV-NSP ELISA

☐ Sensitivity of six NSP-ELISA test kits

Test kit	Animal type	Sensitivity (%)	95% CI
Biovet	Cattle	99.22 (383/386)	97.75–99.84
	Pigs	100 (14/14)	76.84–100
	Total	99.25 (397/400)	97.82–99.85
ID Screen	Cattle	99.48 (384/386)	98.14–99.94
	Pigs	100 (14/14)	76.84–100
	Total	99.50 (398/400)	98.21–99.94
VDPro	Cattle	97.67 (377/386)	95.62–98.93
	Pigs	92.86 (13/14)	66.13–99.82
	Total	97.50 (390/400)	94.45–98.79
IDEXX	Cattle	97.93 (378/386)	95.96–99.10
	Pigs	100 (14/14)	76.84–100
	Total	98.00 (392/400)	96.10–99.13
PrioCHECK	Cattle	98.45 (380/386)	96.65–99.43
	Pigs	100 (14/14)	76.84–100
	Total	98.50 (394/400)	96.76–99.45
KUcheck-F	Cattle	98.96 (382/386)	97.37–99.72
	Pigs	100 (14/14)	76.84–100
	Total	99.00 (396/400)	97.46–99.73

*Sensitivity range 97.50 – 99.00%

☐ Diagnostic accuracy of six NSP ELISA kits

Test kit	Diagnostic accuracy (%)	95% CI
Biovet	99.50	98.72–99.86
ID Screen	99.75	99.10–99.97
VDPro	98.75	97.71–99.40
IDEXX	99.00	98.04–99.57
PrioCHECK	99.25	98.37–99.72
KUcheck-F	98.12	96.93–98.95

*Accuracy range 98.12 – 99.75%

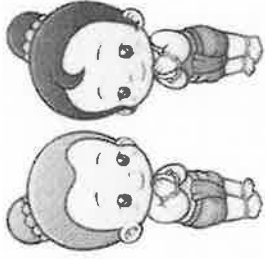
☐ Specificity of six NSP-ELISA test kits

Test kit	Animal type	Specificity (%)	95% CI
Biovet	Cattle and goats	99.00 (99/100)	94.55–99.97
	Pigs	100 (300/300)	98.78–100
	Total	99.75 (399/400)	98.62–99.99
ID Screen	Cattle and goats	100 (100/100)	96.38–100
	Pigs	100 (300/300)	98.78–100
	Total	100 (400/400)	99.08–100
VDPro	Cattle and goats	100 (100/100)	96.38–100
	Pigs	100 (300/300)	98.78–100
	Total	100 (400/400)	99.08–100
IDEXX	Cattle and goats	100 (100/100)	96.38–100
	Pigs	100 (300/300)	98.78–100
	Total	100 (400/400)	99.08–100
PrioCHECK	Cattle and goats	100 (100/100)	96.38–100
	Pigs	100 (300/300)	98.78–100
	Total	100 (400/400)	99.08–100
KUcheck-F	Cattle and goats	92.00 (92/100)	84.84–96.48
	Pigs	99.00 (297/300)	97.11–99.79
	Total	97.25 (389/400)	95.13–98.62

*Specificity range 97.25 – 100%

❖ Conclusions

- The sensitivity range 97.50 - 99.00%, specificity range 97.25 - 100%, accuracy range 98.12 - 99.75%, and concordance range 0.96 to 1.00.
- This study found that the sensitivity and specificity of all six NSP-ELISA kits were statistically similar and significantly.
- The results can be used as information for deciding to use the test kits.
- This allows the Department of Livestock Development to procure a wider variety of kits and use them as a guideline to increase the options for using more NSP-ELISA kits available in the market.



Thank you for your attention

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