



A New Spin: Adapting SpinDx to Enhance Biosurveillance in Low-Resource Environments

Melissa R. Finley, Chung-Yan Koh, and Anup Singh

Problem

Lack of standardized, sustainable, global biosurveillance systems

Inconsistencies in key disciplines impairs modern biosurveillance initiatives

AFGHANISTAN VETERINARY ASSOCIATION (AVA)									
AVA-VTH Monthly Activity Report									
Month: January 2015									
Treatment									
Cases/Diseases	Cattle	Sheep	Goats	Equine	Camel	Poultry	Total		
Foot and mouth disease	12	12	12	12	12	12	12	12	12
Alcelaphine herpesvirus-1	12	12	12	12	12	12	12	12	12
Bovine Viral Diarrhea virus	12	12	12	12	12	12	12	12	12
Infectious bovine rhinotracheitis virus	12	12	12	12	12	12	12	12	12
Lumpy skin disease virus	12	12	12	12	12	12	12	12	12
Bluetongue virus	12	12	12	12	12	12	12	12	12
Total	12	12	12	12	12	12	12	12	12
Vaccination	Cattle	Sheep	Goats	Equine	Camel	Poultry	Total		
Address	18,312	12,429	12,429	12,429	12,429	12,429	12,429	12,429	12,429
Address	18,312	12,429	12,429	12,429	12,429	12,429	12,429	12,429	12,429
Total	18,312	12,429	12,429	12,429	12,429	12,429	12,429	12,429	12,429
Occurrence of Infectious Diseases									
Type of Disease	Cattle	Sheep	Goats	Equine	Camel	Poultry	Total		
Infectious Diseases	12	12	12	12	12	12	12	12	12
Total	12	12	12	12	12	12	12	12	12

Lack standardized data collection



Laboratories are poorly equipped with limited access to reagents



Laboratory diagnosticians are unable to critically analyze samples



- Clinicians cannot detect and diagnose infectious diseases clinically
- Are unable to collect the most appropriate diagnostic sample

Building Capacity for Biosurveillance

Multifactorial problem requires novel solution



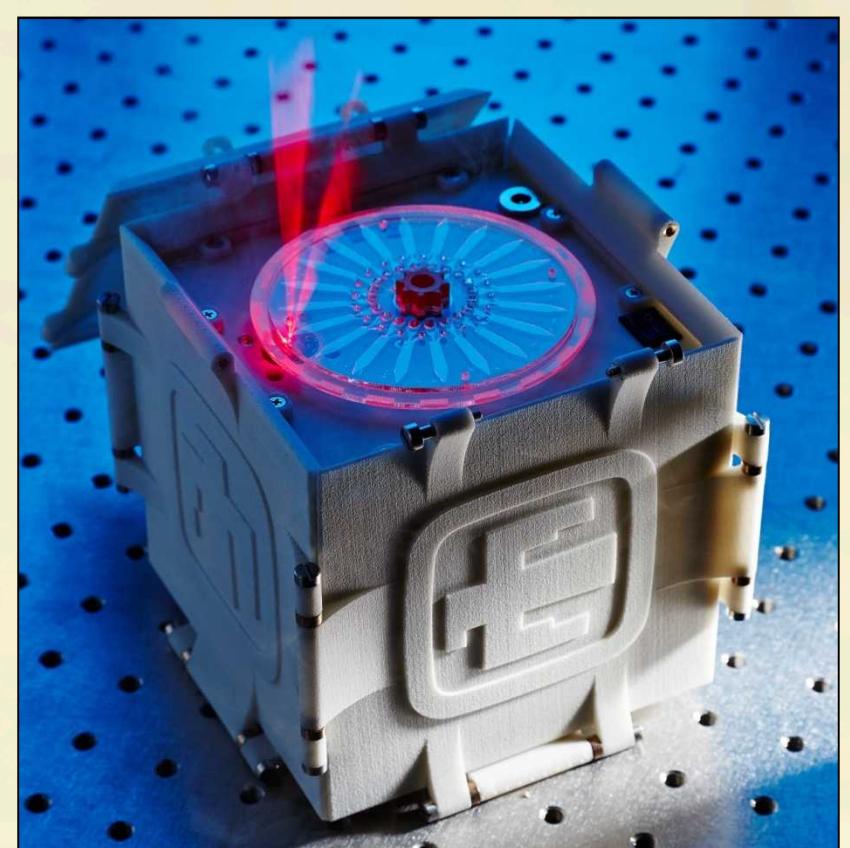
- Astute clinicians are essential to existing surveillance efforts and standardizing training for clinicians globally is cost prohibited
- Diagnosticians with the ability to integrate clinical presentation with laboratory testing are vital but require advanced training

Must develop a solution that can circumvent the role of the clinician and augment laboratory capabilities to collect reliable infectious disease data that can feed into biosurveillance systems

A Sustainable Solution

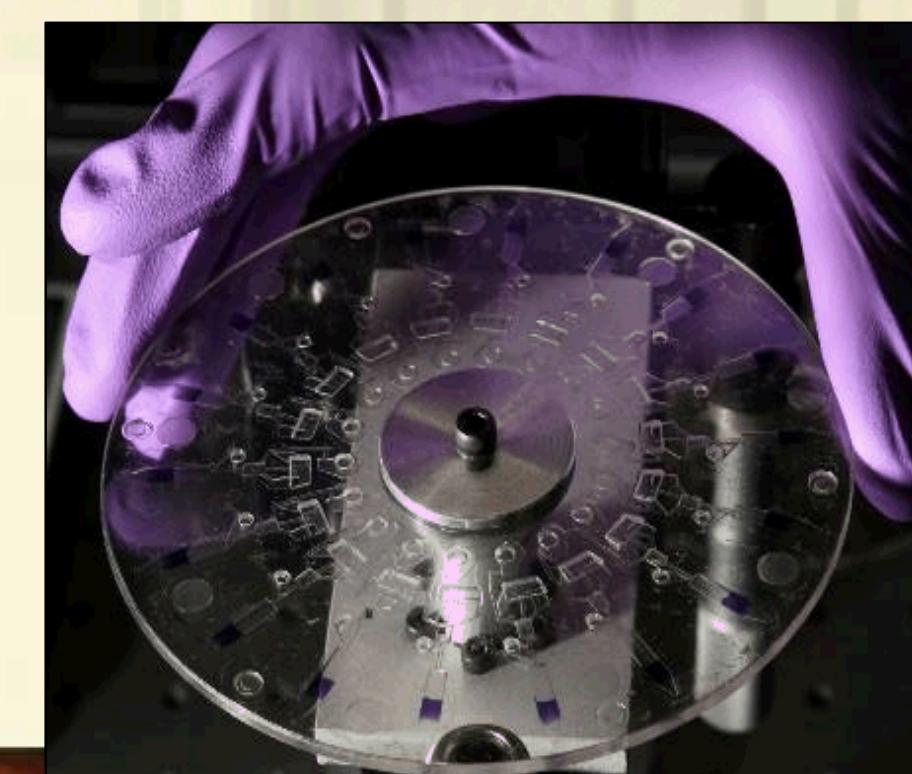
Targeted multiplexing based on syndromes

- Most clinicians can identify clinical symptoms
- Create a laboratory based multiplex system that is targeted based on clinical symptoms



A lab-on-a-disk prototype platform with the potential to run up to 64 simultaneous assays in a matter of minutes using a single drop of blood, saliva, urine, or other sample.

- Small size and cost (< \$1000 for the reader, <\$2 for disk)
- Analytical sensitivity (>10-100-fold better than most commercial ELISAs)
- Fast (sample-to-answer in <15 min)
- No sample prep required



Approach

Identifying targets

- Collect reliable surveillance data on USDA and HHS select agents
- Include common human and animal diseases to enhance sustainability

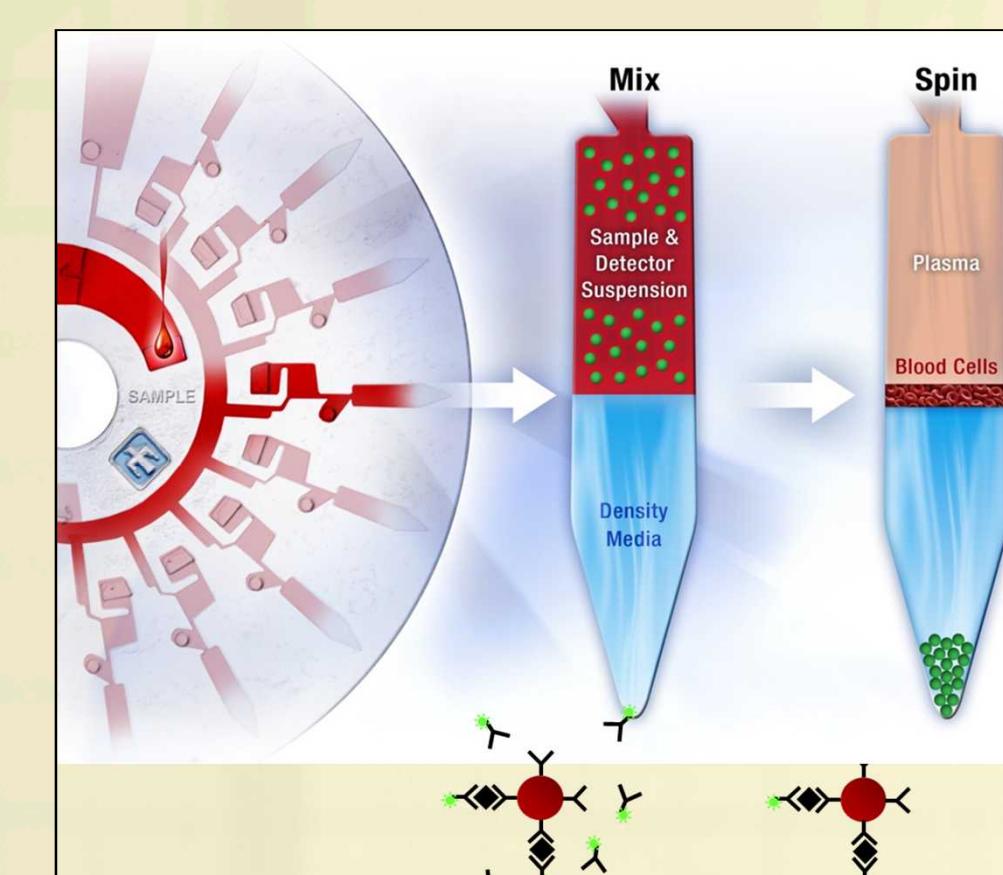
Oral Erosions	Pneumo-enteritis Syndrome
Foot and mouth disease virus	Pestes des Petits Ruminants virus
Alcelaphine herpesvirus-1	Foot and mouth disease virus
Bovine Viral Diarrhea virus	Mycoplasma mycoides capricolum
Infectious bovine rhinotracheitis virus	Sheep and goat pox viruses
Lumpy skin disease virus	Pasteurella hemolytica
Bluetongue virus	Bluetongue virus

Oral erosions syndromic panel

Molecular	Antigen test	Blood (single)	Serum (single)	Blood (multi)	Serum (multi)
BVDV	100 pg/mL	108 pg/mL	110 pg/mL	125 pg/mL	
Blue tongue	44 pg/mL	41 pg/mL	49 pg/mL	48 pg/mL	
PPRV	8 pg/mL	4 pg/mL	10 pg/mL	10 pg/mL	
FMDV	900 pg/mL	955 pg/mL	844 pg/mL	890 pg/mL	
Pastuerella	5 copies	3 copies	5 copies	4 copies	
Mycoplasma	15 copies	8 copies	21 copies	11 copies	

For multiplexed assays, background for antigen tests is 100 ng/mL of irrelevant proteins and background for molecular tests is 1 ug of irrelevant nucleic acids

Underlying technology



SpinDx uses a novel sedimentation approach to conduct bead-based sandwich immunoassays.

Syndromic SpinDx:

Global Biosurveillance Solution

Mitigating existing, emerging, and re-emerging biological threats requires an understanding of the incidence of infectious diseases globally

- Eliminate reliance on clinicians to provide accurate clinical diagnoses
- Simplified diagnostic sampling
- Eliminate the need for sophisticated laboratory technologies that are resource intensive
- Low cost and field deployable

Potential to standardize data collection and provide a solution to create a comprehensive biosurveillance system

