Public Health England

Diagnostic Evidence Co-operative Oxford

NHS National Institute for Health Research

Not to be circulated without prior permission of PHE

Host biomarker based approaches to diagnostic development: Case studies on sepsis and TB commercialisation challenges

Karen Kempsell PhD, Senior Project Team Leader

Professor S.S. Vasan DPhil(Oxon) FRES FRSPH

Senior Business Development Manager

Public Health England

St Hugh's College, Oxford

25 January 2017

Vasan@PHE.Gov.UK +44 – 7917 – 895982

About me

- Ex-McKinsey consultant; PHE's lead for innovation & international consultancy
- Previously Head of Public Health and CEO Asia for Oxitec Limited

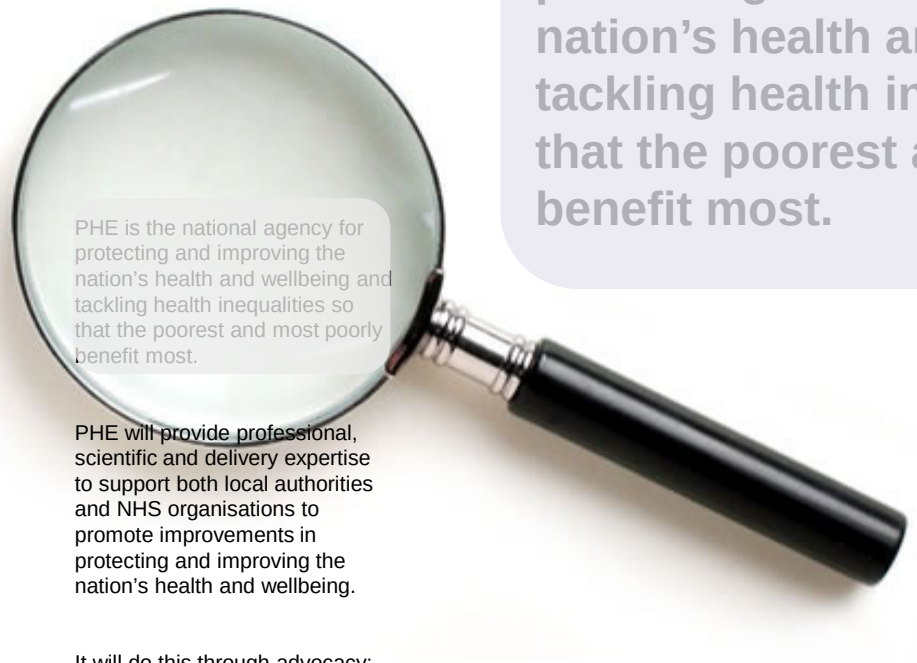
… and my talk

- Chatham House Rule
- Suggestive and illustrative, not prescriptive or comprehensive

Vasan@PHE.Gov.UK +44 – 7917 – 895982

About PHE

PHE is the national agency for protecting and improving the nation's health and wellbeing and tackling health inequalities so that the poorest and most poorly benefit most.



PHE will provide professional, scientific and delivery expertise to support both local authorities and NHS organisations to promote improvements in protecting and improving the nation's health and wellbeing.

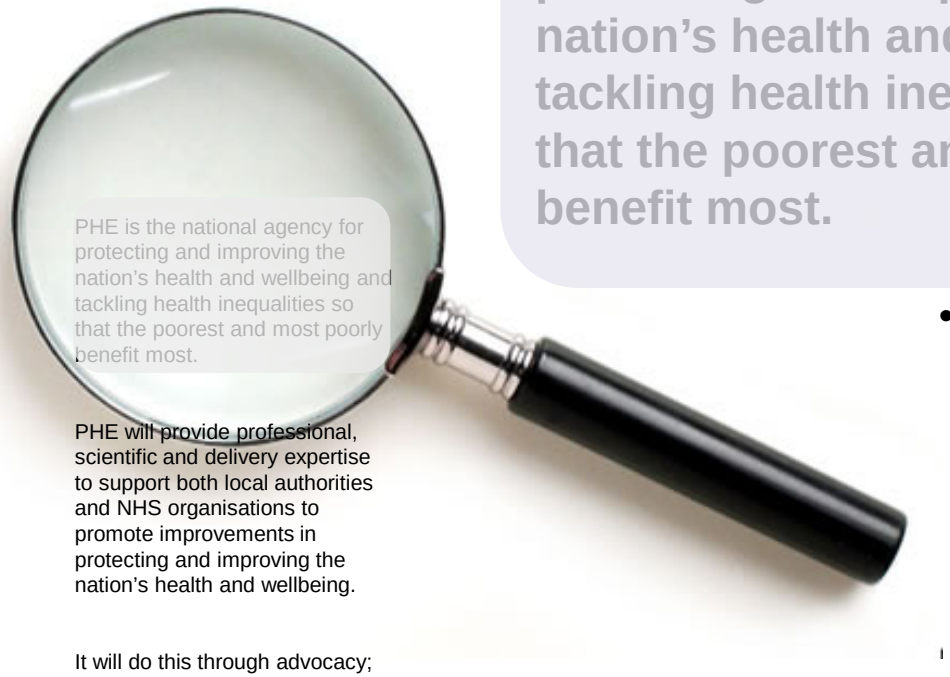
It will do this through advocacy; application of knowledge, evidence and insight; transparent reporting of outcomes; delivery of a nationwide health protection service; and nurturing of the public health system and workforce.

- Operationally autonomous Executive Agency of the UK Department of Health
- National remit with **129 sender bodies**
- TB and Sepsis biomarkers come under our **National Infections Service**
- Single dedicated service to support local innovation, disease control and protection

Vasan@PHE.Gov.UK +44 – 7917 – 895982

About PHE

PHE is the national agency for protecting and improving the nation's health and wellbeing and tackling health inequalities so that the poorest and most poorly benefit most.



PHE will provide professional, scientific and delivery expertise to support both local authorities and NHS organisations to promote improvements in protecting and improving the nation's health and wellbeing.

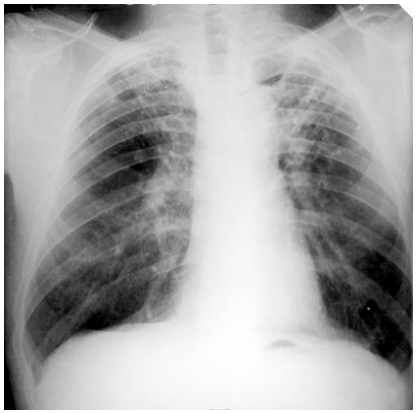
It will do this through advocacy; application of knowledge, evidence and insight; transparent reporting of outcomes; delivery of a nationwide health protection service; and nurturing of the public health system and workforce.

- 2015-2020 priorities:
  - Alcohol, Dementia, Obesity, Tobacco
  - Best start for each child
  - AMR, **TB**, Ebola, etc.

co-innovation

TB

- One of two infectious diseases priorities for England (2015-2020)
- Latent TB diagnosis is key to the WHO's "End TB Strategy" - critical for cost-effective, appropriate treatment and for limiting disease spread both within the UK, India and globally
- Appropriate person-centred intervention is one of the key areas in the "Collaborative Tuberculosis Strategy for England 2015 -2020", and is also likely the case in High Burden countries like India



Vasan@PHE.Gov.UK +44 – 7917 – 895982

TB

- Diagnosis of latent (LTB) and extra-pulmonary TB (EPTB) are challenging, as existing methods, are unreliable and inefficient e.g. Mantoux skin test
- Considerable clinical need for new Dx tests, esp. for LTB and for patient stratification, i.e. high risk of progression to active TB (ATB)
- Rapid Point of Care (PoC) tests have the potential to reduce the TB burden and cost to the health services and should preferably exhibit rapid turn-around time and use readily accessible patient samples e.g. blood

Vasan@PHE.Gov.UK +44 – 7917 – 895982

TB

- WHO has announced global latent TB screening, with a target testing population of >700 million people
- Testing for Latent TB is also a priority in reducing the incidence of TB in the UK. It is likely to be critical for India's pro-active strategy for ending TB as active cases are better managed.
- PHE has a TB-associated biomarker patent that has successfully entered national phase on the 7th November 2016. Further validation for commercial development is in progress
- TB associated biomarkers show great potential for development of Point of Care (PoC) tests, including for EPTB

Vasan@PHE.Gov.UK +44 – 7917 – 895982

TPPs

4 key Target Product Profiles were drawn up at the April 2014 WHO Global TB Programme Meeting. Of these we are focussing on TPP 2-3.

- TPP1 - A point of care sputum-based test as a replacement for smear microscopy
- TPP2 - A point of care, non-sputum-based test based on 'biosignatures'
- TPP3 - A simple, low cost, point of care triage test, ideally suitable for use by community health workers
- TPP4 - A rapid drug susceptibility test (DST)

Vasan@PHE.Gov.UK +44 – 7917 – 895982

TPPs

- PHE is developing both protein and nucleic acid biomarker-based Point of Care diagnostic tests
- Either nucleic acid or protein-based tests would fit a TPP2 product profile; currently being developed for LTB
- Protein-based tests would better fit the TPP3 profile; Protein assays currently being developed for ATB (EPTB & PTB)
- Out of 6 lead biomarkers, 2 are for latent TB.
- We alsohave 3 back-up biomarkers

Vasan@PHE.Gov.UK +44 – 7917 – 895982

Commercialisation

- The potential market in 2020 for a non-sputum based biomarker TB test is in the region of > $65 to $100 million.
- A recent estimate of the 2020 market in 4 high-burden countries (S. Africa, Brazil, China, and India) for biomarker-based tests;
  - TPP2 - 16M tests/year with a value of 65M–97M USD
  - TPP3 - 18M tests/year with a value of 18M–35M USD.

Vasan@PHE.Gov.UK +44 – 7917 – 895982

Commercialisation

- Improved patient management and care (migrants / hard to reach / low resource settings)
- IP owned solely by PHE – engaging with commercial and academic partners for co-development and/or out-licensing.
- It is expected that the TPP3 triage test will be first to market with the TPP2 test following on at a later time.
- Any platform-associated risks may be mitigated as the technology already exists for LTF devices and assays are easily transferrable to other platforms.

Vasan@PHE.Gov.UK +44 – 7917 – 895982

Commercialisation

- Risk 1: Other new technology absorbing the marketplace
  - low risk, study management team involved in next generation testing with current market leaders
- Risk 2: Lack of uptake
  - clinicians and stakeholders are being made aware and engaged in development process
- Risk 3: TB is globally not a profitable diagnostic/therapeutic area in comparison to other diseases
  - Working with Indian partners

Vasan@PHE.Gov.UK +44 – 7917 – 895982

India example

India example

India's frugal innovation + PHE/NHS = powerful alliance + growing armoury of interventions (esp. for AMR-HAI and TB)

Vasan@PHE.Gov.UK +44 – 7917 – 895982

India example

We need

- Access to genuinely new antimicrobial chemistry and patient samples
- Potential solutions to resistant TB
- Insight into the application of other approaches, e.g. vaccines, Dx in India
- Professional networks with Indian colleagues

We have

- Comprehensive UK surveillance data
- Cutting-edge diagnostics
- A strong network of specialist and reference microbiology laboratories
- A clear national strategy
- Clinical strains

Vasan@PHE.Gov.UK +44 – 7917 – 895982

Sepsis

- Similar approach, PHE's patent filed in September 2016
- IP arising from Innovate UK (TSB) Sepsis II call – 'Molecular Prognostic Test for Sepsis for use in Point of Care Setting'
- Partners: Nottingham Trent Uni, SARTRE/Critical Care Alliance
- Validated peripheral blood biomarkers for use in development of 'point of care' diagnostic/prognostic tests for severe inflammatory response syndrome (SIRS), sepsis/severe sepsis

Vasan@PHE.Gov.UK +44 – 7917 – 895982

Sepsis

Current

Diagnosis via classic microbiology
Broad spectrum antimicrobial treatment in all cases
Aggressive organ support in all cases
No predictive tool at the bedside for either outcome or treatment failure

Stratified: Diagnosis via multi-biomarker panel

Personalised treatment
Antimicrobials±immunotherapy
Reliable prediction/monitoring of treatment effect
Reduced complication rate of ICU treatment
Prediction of short and long-term prognosis
Aggressive manipulation of physiology only in those cases where response is likely

Vasan@PHE.Gov.UK +44 – 7917 – 895982

Sepsis

Challenges	Systems biology solutions
Specificity	Group stratification/non-parametric analyses
Sensitivity	Parametric analyses - ANOVA/fold-change analysis
Robustness	Training/test dataset analysis
Precision	Comparison/filtering using pre-existing datasets/non-averaged data analysis
Sensitivity	Systems Biology analysis/cell pre-processing
Reproducibility	Feasibility Study
Multiplex/HTP	Platform selection
Rapidity	Platform development

Vasan@PHE.Gov.UK +44 – 7917 – 895982

Special thanks to colleagues

across PHE, especially Colindale and Porton Down
and to our collaborators across the UK and India

Next event:: London, 30-31 Jan 2017

Horizontal Innovation Conference

Realising the value of cross collaboration

30 – 31 January 2017 | etc.venues St. Paul's, London

IET Events
The Institution of Engineering and Technology