Transforming the design of diagnostic environments for the early detection and prevention of TB transmission in custodial space: A UCL / Tanzania multi-agency joint participatory workshop

REPORT FROM A MULTI-AGENCY JOINT PARTICIPATORY WORKSHOP HELD AT UNIVERSITY COLLEGE LONDON
PREFACE

This Report, supported by UCL Grand Challenges, draws together the findings of this joint UK and Tanzanian initiative. These workshops to address the design of diagnostic environments in custodial settings were devised to facilitate dialogue and mutual learning of the emerging evidence base. Presentations by clinical leads, UCL Medical Microbiology, ‘Find and Treat’, the Mbeya Clinic, Tanzania and architects at The Bartlett demonstrated how there is the need for the exploitation of progressive testing and screening technologies and to understand the interrelationships in both TB transmission in the design of the custodial microbial environment.

Emerging research themes were organised towards identifying a collaborative research programme framework, summarised in this report to present to funder agencies.
01. EXECUTIVE SUMMARY OF KEY FINDINGS

1. There is an emerging evidential base, both UK and Tanzanian, on TB transmission found at custodial reception points of entry into the remand and prison system.

2. Findings from this workshop on the presentation of new evidence, to be published by the Mbeya Clinic in 2016, will overturn accepted knowledge of prison as the TB incubator in this setting rather identifying the presentation of TB by prisoners at entry points to the system as the highest risk; reception points in custody, remand and prison reception processing.

3. Current UK HMP guidance recommends TB screening on prisoner entry. Pressure of prisoner processing (entry and exit through the same space) with increasing prisoner numbers and the priority of ensuring security means that methods of questioning, testing and use of screening equipment in the UK and Tanzania are inconsistent, and reportedly absent.

4. The highest risk of exposure in custodial settings is the police, remand, legal, medical and prison officers, and other prisoners. Poor space design and engineered ‘sick’ microbial environments when combined with weak diagnostic operational management are likely to exacerbate the transmission of TB.

5. Reporting of TB transmission is therefore seen as a potential failure of occupational health and safety, acknowledged with recent awards of compensation to prison officers in the UK, as well recording of the prisoner to prisoner transmission.

6. Prisoner advocacy tells us there is considerable stigma associated with TB transmission in prisons: ‘the invisible disease’. Prisoners present with a tri-morbidity of conditions e.g. HIV and related substances abuse with mental health issues so that without progressive diagnostic testing symptoms at the reception medical interview can remain hidden.

7. Design guidance at reception point processes and space does not consider for design of diagnostic point of care testing, data sharing, collection and transfer across the custodial system. Increasing use of digital organised therapy technologies, biosensors, biomedical performance markers, point of care equipment and technology are not coordinated with security operations, microbiological sample and waste management systems.

8. Continued care and treatment of prisoners without identification of TB is therefore high risk for transmission back in the prison system. Enabling prisoners to come forward for testing requires prisoner advocacy and education alongside continued screening and TB care, for up to 6 months.
This report suggests an initial programme framework leading to reduction of the rate of transmission to points of entry in the custodial system. Applying a multi-method study, demonstrating benefits to occupational health and safety, a UK and Tanzanian 4 pillar study is proposed leading to the design, implementation and installation of diagnostic processes, systems and equipment into custody/remand and custodial reception space.

1. A UCL and Tanzanian cross-disciplinary collaborative testing, reporting, evaluation and implementation study. Applying literature with grounded knowledge based methods, using proven evidence, for the design and implementation of progressive diagnostic molecular, biological and genome sequencing analysis and screening technologies in prison entry and reception points.

2. A case study field examination (4n) with expert situated evaluation in UK and Tanzania. This is required to understand the custody and prison reception environment and space to propose a set of testing with project requirements.

3. The production of clinical, design and environmental performance requirements for retrofit or towards new-build specification for reception entry screening or integrated mobile facility systems.

4. A co-produced programme with clinicians, designers, prison officers/government officers and prisoners of advocacy, education and management structures that also demonstrates benefits to occupational health and safety on the reduction in rates of TB transmission through intervention.

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**Fig 1:**
Transforming custodial medicine and environments for TB prevention

**POINTS OF ENTRY**

- Testing & screening
- Environmental evaluation
- Advocacy & education
The workshop was initiated with presentations from participants reflecting on the transmission of tuberculosis in custodial care settings from their experience. This formed the foundation from which the workshop discussions were developed. Of particular importance was the response to these presentations from a former prisoner who had spent time in many prisons in the UK.

Diversity of perspective was provided by healthcare professions from quite different backgrounds: Dr Ruby Mcharo, a infectious diseases specialist from Mbeya Medical Research Centre, Tanzania, Dr Alistair Story, Clinical Lead Find & Treat, London, and Professor Timothy McHugh, Professor of Medical Microbiology at UCL.

Professor McHugh declared himself as a laboratory microbiologist and his presentation focused on the role of diagnostic tests in interrupting the chain of transmission of tuberculosis. There is a need to consider the appropriate technology for identification of the tubercle bacterium, but importantly where that technology can be implemented. This is exemplified by the use of the GeneXpert molecular test on the mobile Find & Treat X-Ray Unit.

Where is the ‘point’ in point of care? Modern molecular epidemiological tools also have a significant contribution to make as their application is helping us to dissect chains of transmission and provide insights to the fundamental biology of tuberculosis.

A commonly held view is that custodial environments act as incubators of tuberculosis, driving transmission in the prison community and seeding transmission when prisoners are released.

Presentations by Dr Mcharo and Dr Story challenged this model in the diverse settings of central London and rural Tanzania. Presenting evidence from the Find & Treat service, Dr Story proposed a twofold approach to interrupting transmission in custodial communities:

Firstly, he identified a missed opportunity – custody in Police cells and when prisoners are held in Remand. His argument was that those at risk of tuberculosis are highly represented in amongst those who are detained by the Police, only a small proportion of these progress to prison; we should be screening at this point before detainees are released or passed into the prison system.
Secondly, Dr Story highlighted another prison community that is often not considered: prison staff. This group are at risk of tuberculosis and importantly are embedded in the local community with social networks reaching beyond the prison.

Interestingly, these observations of TB transmission in London had real resonances with the experience presented by Dr Mcharo in relation to prisons in the Mbeya region of Tanzania. Describing data obtained by colleagues and soon to be published, Dr Mcharo showed that the prisons in Mbeya (serving a rural and urban community) rather than acting as an incubator to TB are acting as a focus or concentrator of TB patients. Detainees are often in remand for many months and so if TB treatment is initiated then there is opportunity for treatment to be completed.

Lastly, Architect Philip Astley presented reflections on the custodial environment from a visit to a new-build prison in central England. Prison designs are a legacy of the 19th Century ‘Fordist’ prison with inherent planning tensions: security and fire safety against access and entrance points, and centralised use of resources against introduction of virtual infrastructure for distributed systems, testing and communications. Prisons are overwhelmingly about maintaining security, taking about 80% of the prison budget. 20% is spent on rehabilitation and activities are organized in a central core: the minority (prison officers) moves the majority (prisoners) which is ineffective in terms of time and management resource (Cottam 2002). Use of technology was seen on the wings; an automated ‘kiosk’, where prisoners were able to book family visits, outpatient appointments, manage their prison banking. However, the potential for integrating diagnostic screening equipment is not reflected in design guidance for prison reception, a highly pressurised, constrained space that requires prisoners to both ingress and exit each day.
You are searched for weapons and drugs at prison reception, but you walk through with TB
- Expert by Experience, Prisoner Advocate

Scenario planning methods used to draw out effective scenarios of future care delivery were applied to facilitate and to bring forward decisions by the group about the opportunity for transforming diagnostic environments within the custodial system in UK and Tanzania.

The multi-disciplinary group (10n UK and Tanzania: Design and construction (3n), Project management (2n) Microbiologists (2n), TB/HIV practitioners (4n), Prisoner advocate (1n)) considered the drivers of TB transmission in custodial environments.

Those that present the highest risk, but also the highest opportunity in response to the drivers of TB transmission:

**a. Occupational health priority:** there is high risk of transmission of TB from prisoner to prison employed workforce. The financial case for intervention is evidenced of successful litigation by prisoner officers in the UK who have contracted TB within the prison system. In turn, prisons, whether sited in urban or rural settings create distinct ‘prison village’ communities. In Tanzania prisons in rural settings will also contain residential accommodation for prison officers and their families outside the secure perimeter.

**b. Security v health processes:** The predominant custodial culture of the prison is for the maintenance of security. If there is to be a greater emphasis on the role of prisoners officers to mange new health processes, e.g. in the operation of new diagnostic equipment and technology, and for the continuing support of prisoners in their treatment programme this will require new health with security protocols.

**C. Prisoner reception triage:** prisoners held in remand, custody and within the reception process are held in small holding spaces. Often from pressures of increasing numbers in the system these may be dual, or in the case of Tanzania, multiple occupancy spaces. Weakness in microbial testing processes means that both prisoners and prison officers are vulnerable to the transmission of TB at these points in the system. The undiagnosed prisoner also places the prisoner supporter at risk at times of visitor/family visiting.

**d. Stigma of TB diagnosis:** management of diagnostic privacy within a culture of trust is required in response to the stigma of TB diagnosis and perception as the ‘invisible disease’. Initial prisoner health screening is weighted towards addressing the predominant disease prevention programmes of HIV, substance abuse and associated mental health issues. Positive diagnosis would kick-start a treatment programme mentored by prisoner advocates on the prison wing and for continued rehabilitation of prisoners on release.

**e. Biology of transmission by new screening types with the introduction of diagnostic technology:** the introduction of new diagnostic testing and reporting for surrogate, latent and active TB processes requires consideration of the scope and
scale of equipment, blood skin sampling, including point of care testing, the data management and the interrelationship of laboratory systems and the processing of microbiological samples. This means current space use and provision of infrastructural with systems will need to be evaluated prior to installation of diagnostics.

f. **Microbial performance of the holding space:** the evaluation and testing of spaces where prisoners are held is required; often in small poorly ventilated environments at the point of entry, or larger residential spaces when prisoners are held in remand in Tanzania, these environments are likely to exacerbate the transmission of TB.

g. **Progressive use of diagnostic technologies in sampling and reporting:** the introduction and use of new diagnostic testing markers such as ‘GeneXpert’, increasing use of tablet based digital organised therapy (DOT), biomedical performance markers, point of care laboratory equipment, total patient management systems for data logging, tracking and monitoring all require new performance metrics when introduced into reception spaces.

h. ‘**Incubator opportunity:**: the successful treatment of prisoners identified with TB requires robust screening at the point of entry to enable a 6 month plan of care for those prisoners identified with TB. Prisoner remand in Tanzania can be up to two years prior to sentencing but shorter periods between remand and sentencing in the UK require treatment programmes to be monitored at the point of entry and potentially completed outside the prison community.

i. **Community of practice:** there is potential to create a community of practice of education and training through the introduction of health diagnostics: diagnosis and self-management of the treatment programme by the prisoner as part of a rehabilitation, education and skills programme, potential transfer of skills for data management supporting the health professional utilising DOT, an expanded role of the prison officer on health protocol management skills in health diagnostics and treatment. Peer to peer education advocacy by rehabilitated offenders.

j. **Buildings and infrastructure condition:** the high security or open category of the prison and constraints within existing built infrastructure are likely be significant factors to the successful introduction of new diagnostic processes. But new space may not be required, and capacity and adaptability of the existing space evaluated. Review, challenge to, current space-use and systems specifications, introduction of miniaturised handheld diagnostic kit, the ability for remote systems and laboratory testing, will inform analysis of existing facilities within security context.

k. **Information, design guidance and policy:** the potential is to inform new design guidance for prison receptions, screening specification and space-use and systems design. New information will inform policy for TB transmission, regulation and standards. Value markers will inform the economic benefit from transformation of the screening system, prevention and rehabilitation programmes will be informed by the introduction of prisoner and prison officer advocacy and education programmes. The transfer of skills from the introduction of health protocols and diagnostic ownership by the prisoner will inform new skills opportunities.
03. INTERDISCIPLINARY WORKSHOP
FINDINGS (CONT.)

The presentation of TB by prisoners on entry to the system suggested key points of potential screening for active and latent TB testing, and the communities they affect. At each in the process there is a considerable risk of release of the prisoner to the community without diagnosis.

Points of potential diagnostic screening at points of access in the system:

**Police Custody, Single and Shared Cells:** Prisoner, Police and Legal Officers +Transfer to Court risk

**Court Remand:** Prisoner, Prison Officers, Police and Legal Officers

**Remand Prison:** Prisoner, Prison Officers, Police and Legal Officers

**Court Convicted Prison:** Prisoner, Prison Officers, Police and Legal Officers

**Prison Reception:** High Security, Open Prison, TB Hospital Prison

**Prison community:** Prisoner, Prison Officers, Legal Officers, Prison ‘Village’ (Officer families), Visitors

Fig 2: Opportunities for diagnostic screening - points of entry in the custodial system
04. STEPPING STONES TO A FRAMEWORK OF RESEARCH

The point of entry is a ‘triage’ at reception for new screening activity. The need is to understand the biology of transmission of TB and the risk presented along with understanding the pressures of the daily prisoner entry and exit to ensure quality of care for the prisoner, prison officer and health professional.

Screening Interventions that inreach into the service at these entry points will require supporting infrastructure, quality protocols for sampling, skills in use of equipment and resource to undertake the activity.

Screening and sampling technologies are to identify active, latent and masked symptoms. Screening for TB may be complicated, and overshadowed by more obvious symptoms associated with presentation of tri-morbidity of substance abuse and HIV/Hepatitis.

Reporting will be supported by digital sampling/imaging data collection and transfer the techniques were identified as:

- Radiology Screening
- Microscopy
- XRay

A multi-method of approach to identify prisoners and prison officers with TB at points of entry, acknowledging the pressures of prisoner processing in the reception and the stigma associated with the disease could include:

**Step 1**
Study to determine prevalence in the reception workplace at points of entry in the system.

**Step 2**
i. Self Reporting: by use of simple questionnaires would facilitate sampling process through – self-reporting by the prisoner to the health professional/prison officer. And if prisoner withholding information,

ii. Clinical evaluation and reporting by either a health professional or trained prison staff

iii. Use of biosensors in receptions areas (and in prison wings)

**Step 3**
Working practices: understanding custodial and health processes, activity flows with accommodation types, individual space performance evaluation: intervention requires evaluation of the custodial processes for health screening, space for new equipping (size and scale), technology systems capacity and condition, relationship to laboratories, storage (materials and automated sampling), digital imaging reporting, transport samples and waste management, microbial environment performance (ventilation etc), prisoner and staff assessment space and delivery of results.
04. STEPPING STONES TO A FRAMEWORK OF RESEARCH (CONT.)

Step 4

Prisoner (peer) mentoring/discrete education and tracking on positive identification of the disease whilst ensuring privacy for prisoner and officer is maintained. Prison officer require same screening approach but require different support systems. Prisoner incentivisation/Rewards to ensure considered to ensure continuous self-medication by the prisoner for a period of 6 months, as well as using supporting video/tablet technologies (DOT) to observe treatments are kept up.

Step 5

Economic evaluation of where the screening intervention is best located i.e. the most effective points of entry and the ability of the environment to accept screening activity, relationship between use of technology to intervention in each physical environment, least impact, or recommendation for renewal for the physical fabric.
05. CONCLUSION AND THE WAY FORWARD

In exploring the ideas presented in this workshop it has become clear that there are common themes between the UK and the Tanzanian settings and so lessons learnt are of global relevance. The importance of the point of entry and engagement with healthcare services from very first interaction with the judicial process became evident. Another key point of learning was the need to consider prison workers and the extended community around them.

The workshop has confirmed the value of working across 2 apparently diverse systems and has identified the key themes for further study. This document will now be shared with potential funders as a means to open dialogue with regard to the resource to carry out these important studies and ultimately inform the interventions that will reduce TB transmission.
## WORKSHOP ATTENDEES AND REVIEWERS

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Klopper, M (2013). Emergence and Spread of Extensively and Totally Drug-Resistant Tuberculosis, South Africa. EID Journal, Volume 19, Number 3


Public Health England (2014). TB in the workplace Information for all employers
BIBLIOGRAPHY (CONT.)

Robert W Aldridge, Andrew C Hayward, Sara Hemming, Susan Yates, Gloria Ferenando, Lucia Possas, Elizabeth Garber, John M Watson, Anna Maria Geretti, Timothy D McHugh, Marc Lipman, Alistair Story. Detecting and managing latent tuberculosis and blood borne virus infection in a UK homeless population: a cross sectional study with outcomes of referral to healthcare services. (SUBMITTED)


TB cases in London with one or more social risk factor. Source: London TB Register; Includes Homeless, Drugs, Alcohol, Mental Health


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