Umoya omuhle

Taking a whole systems approach to TB infection prevention and control in South Africa

Participatory workshop on patient flow & waiting times

08 August 2019, Salt Rock

•

Summary report | Version 2.4 | 31 August 2020

LONDON SCHOOL of HYGIENE &TROPICAL MEDICINE
AHRI AFRICA HEALTH RESEARCH INSTITUTE
Queen Margaret University INSTITUTE FOR GLOBAL HEALTH AND DEVELOPMENT
University of Cape Town · Iyunivesithi yaseKapa · Universiteit van Kaapstad
IDS Institute of Development Studies
UNIVERSITY OF KWAZULU-NATAL INYUVESI YAKWAZULU-NATALI
UCL

Executive summary

This report summarises the findings of a participatory workshop to share knowledge and to develop methods to measure and modify patient flow in South African primary health care (PHC) clinics. Held in August 2019 in KwaZulu-Natal, South Africa, the workshop was part of the *Umoya omuhle* study, a multidisciplinary initiative funded by the Economic and Social Research Council (ESRC) of the United Kingdom (UK), taking a whole systems approach to tuberculosis (TB) infection prevention and control (IPC) in South African PHC clinics.

Participants and procedures

Participants had wide-ranging expertise, including clinical and public health practice; health facility management; IPC; health services research; health care policymaking; mechanical engineering; architecture; public infrastructure; and community engagement.

The workshop adopted the principles of co-design and was divided into three sessions 1) facilitated discussion around the issues involved with measuring and modifying patient flow; 2) small group collaboration to design a) low-cost methods to measure flow and waiting times and b) strategies to reduce waiting times and improve flow; and 3) group feedback of consensus findings, discussion, and critique.

Key findings

Agreed problem statements	***"Most clinics are overcrowded at particular times***
	"Patients have to wait for too long"
	"The space and use of space is sub-optimal"

Approaches to measuring waiting times and patient flow should:	Be designed to complement the way in which the data will be used
	Distinguish between a 'full' measurement exercise and a 'diagnostic' exercise
	Be useable across a wide range of facilities
	Provide data that are specific to a particular facility
	Be low-tech & flexible
	Not require too much up-front investment or extensive technological infrastructure
	Be acceptable to a wide range of stakeholders
	Not be excessively expensive to implement
	Require minimal additional personnel

Current methods to measure waiting times are difficult and time-consuming: they generate data that are useful for monitoring trends and evaluating the effects of large-scale interventions at district level and higher, but are less useful at clinic level, in part because of time delays and issues with data flow. There is a

need for a flexible 'diagnostic' method that does not require extensive planning or human resources to conduct, that can easily be adapted to the circumstances of an individual clinic, and that generates data that can be made available, quickly, to individuals at the clinic to allow changes to the organisation of care. Such a method could be derived from standard 'waiting time survey' methodology already in use, though the approach most likely to be effective in the long term would involve investment in infrastructure and integration with other clinic systems, such as the filing system and, ideally, a queue management system.

Approaches to <u>modifying</u> waiting times and patient flow should:	Aim to effect lasting change
	Be articulated clearly to stakeholders
	Be data-driven and designed to fit patient preferences and behavioural patterns
	Be adaptable to the clinic size, population, climate, and culture
	Be introduced in a way that is sensitive, simple, and transparent
	Prioritise safety of HCW and supported by documentation, training, and oversight
	Understand the limitations imposed by the setting
	Account for and include measures to minimise staff resistance
	Aspire to improve the overall delivery of health care
	Be collaborative and interdisciplinary
	Encourage exchange of ideas with the community

Attempts to modify waiting times and flow must be designed with consideration of established relationships within the clinic and its working culture; the extent to which the facility manager is empowered and confident in making changes; power dynamics between the manager, staff, and patients; the design of and limitations imposed by the physical structure; and patient preferences. A system that gives most patients timed appointments is likely to be the most effective strategy, particularly if combined with an automated queue management system. Implementation, however, is complex, and initial attempts should expect to fail. Chances of success will be improved by an iterative, data-driven approach, and use of a system that can be easily adapted to changes in circumstances.

Next steps

The discussions and suggestions from this workshop are highly relevant to the objectives of the larger study and have helped shape investigators' thinking around mechanisms that determine the efficacy, feasibility, and sustainability of interventions to reduce risk of TB transmission in PHC clinics. Pilot studies and operational research are needed to further evaluate effectiveness and implementation barriers. Giving facility managers the ability to easily measure waiting times and patient flow in their facilities, access the data collected, and take appropriate action is important not only for IPC but also for developing more efficient clinics and a learning health system.

Contents

List of tables

List of figures

List of abbreviations

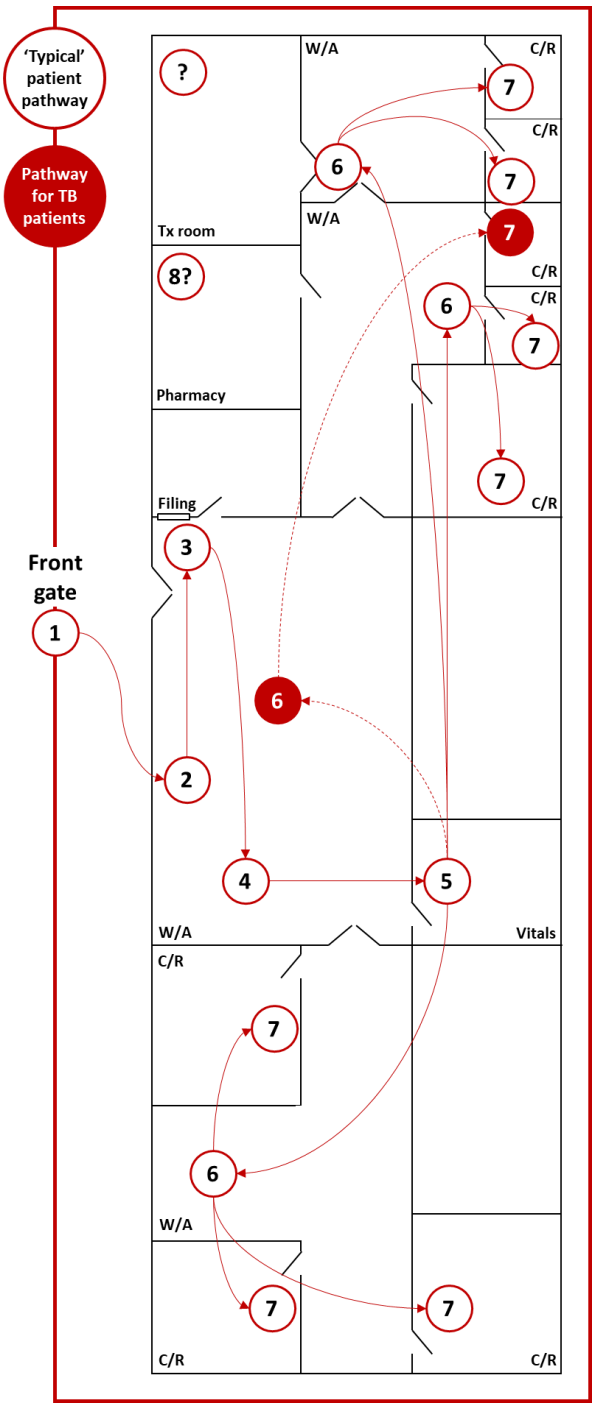
CHC	Community health centre
DoH	Department of Health
HCW	Health care worker
IPC	Infection prevention and control
IUSS	Infrastructure Unit System Support
KZN	KwaZulu-Natal
Mtb	*Mycobacterium tuberculosis*
NHI	National Health Insurance
PHC	Primary health care
TB	Tuberculosis
UO	Umoya omuhle
WHO	World Health Organization
WTSE	Waiting times and systems efficiency

Introduction

Minimising time spent in health facilities has been part of World Health Organization (WHO) tuberculosis infection prevention and control (TB IPC) guidance since 2009.[1] However, implementing this policy in busy primary health care (PHC) clinics[a] in South Africa, where there is huge variability in clinic size, organisation, and patient load, is complex. South African PHC clinics are dynamic spaces through which large numbers of people pass every day. Most PHC clinics provide several services; this leads to multiple, intersecting pathways and 'mini-queues' within each facility (Figure 1). Any attempt to improve patient flow in PHC clinics requires an understanding of the common pathways taken by patients and knowledge of where individuals spend their time when they are not accessing a 'service point'.

An individual's path through a clinic can also be visualised as linear (Figure 2), a process involving several stages, occurring in sequence, and mandated points of interaction with health care workers (HCWs). The time spent in contact with HCWs is often much less than time spent waiting. This has implications for patient satisfaction; for the efficiency of the clinic as a 'production line'; and for the risk of within-clinic transmission of diseases such as TB.

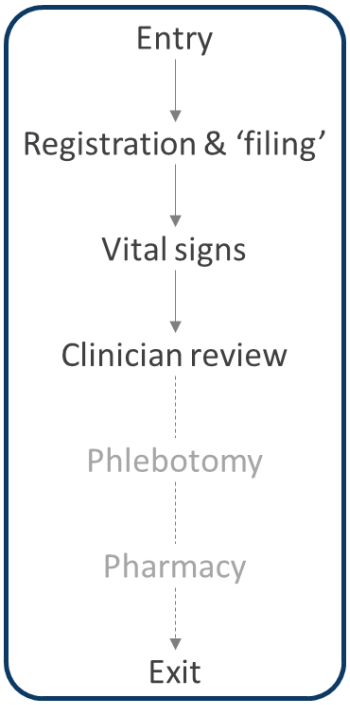
Figure 1. Representation of real-world 'messy' patient pathways in a small PHC clinic



CR: consultation room; PHC: primary health care: TB: tuberculosis; WA: waiting area

[a] The term 'PHC clinic' is used in this report to refer to all primary health care facilities in South Africa, including Community Health Centres (CHCs).

Figure 2. Simplified linear patient pathway through a clinic



Measuring waiting times, efficiency, and flow

In South Africa, clinic efficiency is partly estimated through measuring waiting times.[2–4] These are useful also for estimating cost-effectiveness and patient satisfaction[5] and can be used to monitor patient flow.[6–8] However, there are important limitations in the methods used (which rely on paper data collection tools and manual entry of time data), most critically the **time taken to process the data** and the **availability of the data** to the managers of individual facilities to allow changes to be implemented. There have also been few attempts to use the time individuals spend in health facilities to estimate the risk of communicable disease transmission.

For pathogens that are transmitted via the air, such as *Mycobacterium tuberculosis* (*Mtb*), one of the important determinants of the risk of transmission is the **duration of exposure** to 'contaminated' air. Closely related are **the characteristics of the space** in which the exposure takes place; the **frequency of air changes** within that space; and the **susceptibility of the individuals** exposed.[9,10]

Workshop rationale

Through work done to estimate patient flow and waiting times as part of the *Umoya omuhle* study, a large, multidisciplinary research initiative taking a 'whole systems' approach to TB IPC in South African PHC clinics,[11] we identified a need for innovation and collaboration with individuals who:

1. were familiar with the workings of South African PHC clinics;
2. had experience of measuring waiting times; and
3. had experience of implementing changes in the organisation of care and patient flow in these settings.

We organised a workshop to allow for discussion of these issues and for the exchange of ideas around ways to better measure and improve patient flow in South African PHC clinics.

Aims and objectives

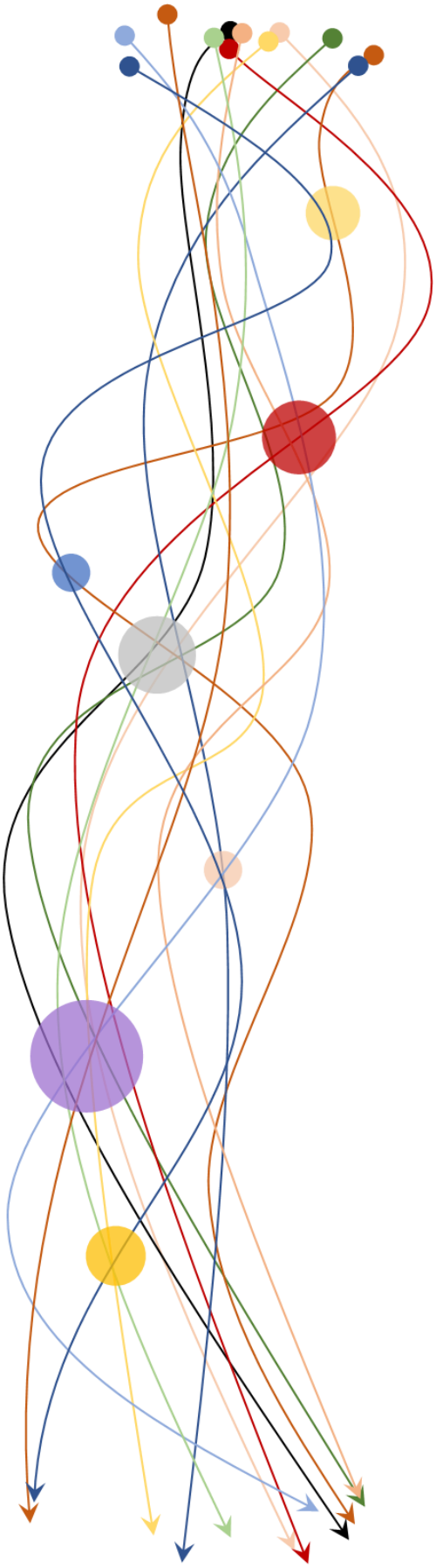
This workshop aimed to bring together experts in waiting times, physical space, person movement, primary health care policy, primary health clinic operations, and infection prevention and control to share knowledge and perspectives around measuring and modifying patient flow in South African PHC clinics and to develop methods to assess and improve patient flow in these settings.

Objectives

1. Facilitate discussion and create a space for the exchange of ideas around measuring and modifying patient flow and waiting times in South African PHC clinics;

2. Design a rapid assessment tool to assess waiting times, flow, and crowding in South African PHC clinics; and

3. Devise simple short- and long-term strategies to reduce crowding/improve flow in South African PHC clinics (ideally implementable by facility managers and/or other health care professionals).



Methods

We aimed to conduct the workshop in line with the principles of **co-design**, "*a practice where people collaborate or connect their knowledge, skills and resources in order to carry out a design task*";[12] it is: **inclusive, respectful, participative, iterative, and outcomes-focused**. We therefore considered each workshop participant an expert in their field and equally important to the process. We did not request informed consent and did not audio record. We used an extended icebreaker in an attempt to disrupt power relations, and tried to ensure that the views of all participants were heard.

Participants

We made attempts to attain a rough balance between participants from KwaZulu-Natal and Western Cape provinces. Attendees (Supplementary table 1) had wide-ranging expertise, including clinical and public health practice; management of PHC clinics and community health centres (CHCs); IPC; health services research, PHC policymaking; mechanical engineering; architecture; design of health facilities; public infrastructure; and community engagement.

Workshop structure

The workshop was divided into three sessions (Table 1).

Table 1. Description of workshop structure: duration, objectives, and focus of sessions

Session	Format	Duration	Objectives	Key discussion themes
1A	Large group	1 hour	To generate a list of 'desirable criteria' that any method should look to fulfil, including key parameters for measurement, implementation strategies, and data management principles.	Methods used to measure waiting times and patient flow, participants' experiences of collecting and using the data, and shortcomings in the methods.
1B	Large group	1 hour	To generate a list of suggested 'considerations' for anyone designing or implementing similar strategies.	Existing strategies and initiatives used to modify patient flow and reduce waiting times
2	Two small groups	3 hours	Group 1: to design one or more new methods to measure waiting times and patient flow. Group 2: to design strategies to reduce waiting times and improve patient flow.	In light of the criteria listed during the first discussion, map out in detail how a method would be implemented in different settings.
3	Large group	1 hour	To report, briefly, on the outcomes of the small group discussions.	Critique and discussion of methods or strategies proposed.

Report-writing

This report was drafted by the workshop facilitator (AK) using notes and photographs made during the workshop. All participants were given an opportunity to review and shape the final report.

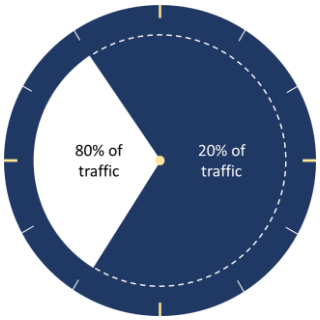
Findings

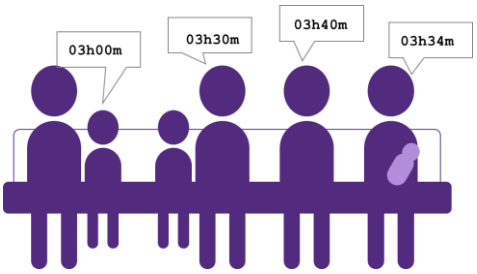
Problem statements

To guide discussions for the rest of the day, the group was presented with three statements describing the 'problems' at hand. Participants were asked to examine and, if necessary, amend these statements so they reflected the group's overall view in relation to waiting times, patient flow, and TB IPC.

"Most clinics are overcrowded at particular times"

Originally phrased as "most clinics are overcrowded". It was felt important to qualify that overcrowding was not a continuous feature, but was concentrated around particular times of day. This re-framing led to wider acknowledgment that both the availability and efficient use of resources should be discussed.



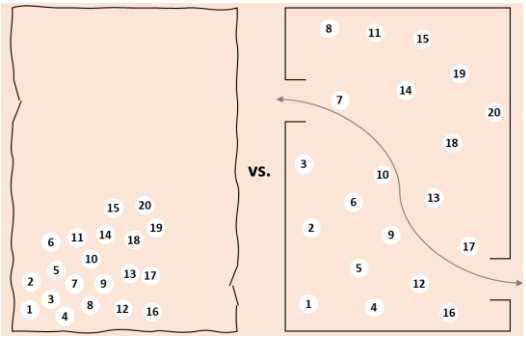


"Patients have to wait for too long"

This statement stimulated discussion of the variability involved in generating estimates of waiting times, such as variation in clinic location, size, management policies, designation, and the times at which estimates are made.

"The space & use of space is sub-optimal"

Originally phrased as "the use of space is sub-optimal", but there was consensus that physical structures themselves are often not fit for purpose or were not designed to minimise risk of transmission of pathogens such as *Mtb*.



Large group discussions were wide-ranging and energetic; participants recounted their experiences of measuring and make changes to patient flow. As the discussions progressed, the facilitator created lists of "criteria" to guide the small group discussions (Tables 2 and 3).

The small groups worked intensively for over three hours. The summaries below aim to capture the scope and depth of the discussions as well as the progression of ideas. At times, the flow of ideas has been rearranged to create a simpler narrative for this summary.

Measurement of waiting times and patient flow

Part I: Requirements for methods to measure waiting times and patient flow

The results of the large group discussion are summarised in Table 2.

Table 2. Principles for designing methods to measure waiting times and patient flow in South African primary health care clinics

Characteristic	Requirements (A method should…)	Comments
Scope & intention	**…be determined** by the way in which the data will be used and who will used them. **…distinguish** between a 'full' exercise and a 'diagnostic' exercise.	Data fed up to district, province, and national level are useful for trend analysis, but less useful for analysis of flow in individual clinics. A diagnostic tool would provide less comprehensive data, but would provide data more quickly, allowing for changes in close to real-time.
Adaptability & specificity	**…be useable** across a wide range of facilities without needing much modification to local circumstances. **…provide** data that are specific enough to make decisions around the organisation of care in a particular facility.	Some South African guidelines recommend enrolling the first 100 individuals who attend the clinic. It was agreed that this approach would likely lead to selection bias. A higher number of measurements involving a smaller number of attendees per exercise could be effective and feasible.
Practicality	**…be low-tech & flexible** (e.g., paper tools, though this require data entry, which is time-consuming and may be expensive). **…if higher-tech, not require** too much up-front investment, depend too heavily on existing infrastructure, or breach ethical guidelines.	There was general agreement that any method should aim to exploit technology to maximise data quality, maximise efficiency, and make the process as 'light touch' as possible. However, there was also caution about becoming over-reliant on complex or expensive technological solutions that could make the process more vulnerable to failure.
Acceptability	**…be acceptable** to a wide range of stakeholders **…not be excessively expensive** to implement **…require minimal additional personnel**	There was also broader discussion around the ethical issues involved with collecting these types of data; conversations focusing on protecting patient confidentiality and minimising disruption to clinical services.

Part II: Small group discussion

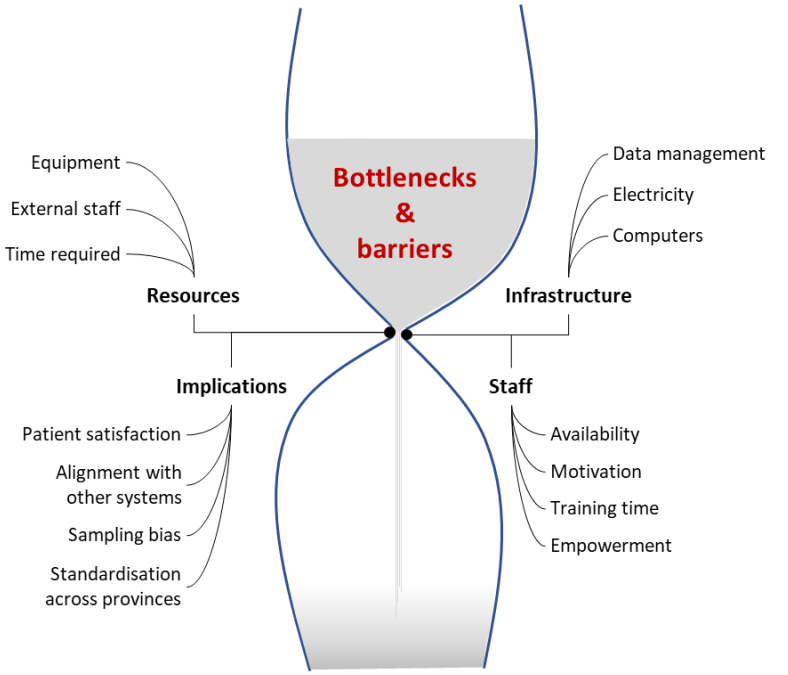
Several ideas emerged around ways in which flow and waiting times could be measured. Participants built around the structure developed in the morning session, defined what was being measured (*numbers of people* and *movement*), and revisited the targeted users of the tool and data (*research* vs. *management*). They also discussed the scope of the method (*should we measure staff time as well as patient waiting time?*) and potential trade-offs involved in using a 'diagnostic' tool instead of conducting full waiting times exercises (*will we lose the ability to detect bottlenecks and knock-on effects on flow?*).

Additional constraints

The methods currently under use in South Africa were discussed briefly, including the method recommended by the Ideal Clinic initiative;[13] a modified approach used in some Western Cape clinics; the use of unique barcodes and scanners in the *Umoya omuhle* study;[14] and simple periodic headcounts in different parts of the facilities.

Some time was spent discussing further the potential operational barriers to adopting a new method (Figure 3). These included buy-in from staff and the time required for conveying the importance of the exercise and improving staff motivation – measures to empower and train staff in the methods were described as helpful in sustaining these activities over time. The poor infrastructure at some facilities, particularly the lack of computing equipment and connectivity, but also larger issues such as rolling blackouts, were seen as major obstacles to a technological solution. The group also discussed the longer term implications of the choice of method, with impacts on integration with other data systems (e.g., the Primary Care Health Information System in Western Cape province), skewed data because of systematic bias in sampling, and difficulties in standardisation and comparison between facilities and provinces.

Figure 3. Operational bottlenecks and barriers to more frequent, 'diagnostic' measurement of waiting times



Sampling issues

Variations to current sampling approaches were explored - for example, conducting the exercises more frequently and at different times of day to at least partially account for the variability in clinic use over time. A major obstacle to doing this effectively was the current logistical complexity of running the exercises; if the method were easier to use, it would be simpler to repeat, and therefore reduce the need to have to choose either a random sample of patients or to focus on a sub-group.

The group agreed, however, that some sampling approaches could be useful – for example, if there were specific concerns about waiting times for a particular service, an exercise could be conducted that focused only on individuals attending clinic for that service (though any such exercise would have to account for other activities underway in the clinic that day, staffing levels, and so on).

Although the data from a 'diagnostic' exercise would be used primarily by staff at that clinic, there remained concerns around how decisions made around sampling (and other areas) would affect the representativeness of the data and implications for comparing between clinics or provinces, and a reiteration of the need for standardisation and transparency across services, clinics, districts, and provinces.

Potential solutions

Potential technological solutions identified by participants included camera-based systems, radio-frequency identification (RFID) tags, mobile barcode scanners, and fixed 'touch points' (similar to airports) where patients could scan themselves. Some of the guiding principles for design and implementation are outlined below.

1. Any new method based on barcodes should be aligned with the existing **filing system** (i.e., patient barcodes should be matched to their clinic files).

2. **Touch points** should be in every room, at a minimum, but could also include additional points to assess queue length and clustering in particular parts of the clinic

3. Scan-in and scan-out points should be **calibrated according to the specifics of the service** in question (e.g., will be different for the pharmacy vs. a consultation room)

4. A method could be built-in into a **ticketing system** that could be used routinely to better manage the multiple mini-queues that exist for different services (see also 'Strategies to modify' section, below)

5. The method should **differentiate between individuals with appointments** and those who walk in. This should be accounted for in the producing and distributing barcodes or cards – this will also raise challenges for connecting waiting times measurement to the filing and other systems.

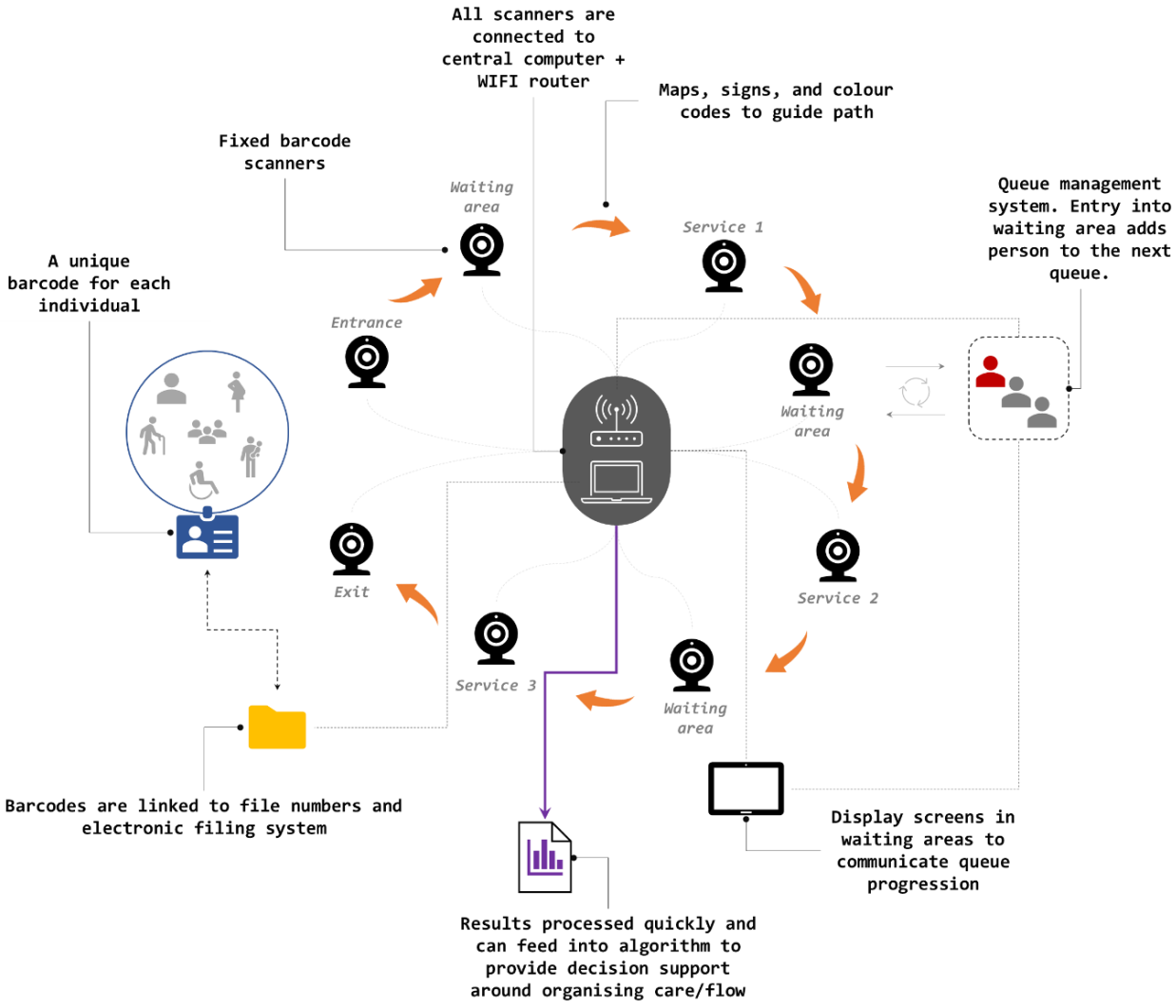
6. Any data entry system must be "locked off"; efforts should be made to limit susceptibility to manipulation or interference.

7. Wider clinic processes should be aligned in a way that supports a queueing system and with the overall goal to move, efficiently, individuals who have an appointment.

8. The system needs to be flexible to extenuating circumstances and changes in patient load.

A version of an 'ideal' method, assuming that some of the practical bottlenecks and barriers discussed above had been accounted for or bypassed, is depicted in Figure 4.

Figure 4. Visualisation of a theoretical method to estimate flow and waiting times that would be integrated with filing and queue management systems



Other measurements relevant to IPC

In addition to methods to measure the more 'traditional' metric of waiting times, ways to estimate 'crowding' were discussed in regard to their relevance to disease transmission and IPC.

1. **Measure ventilation**

   The use of headcounts and estimation of carbon dioxide (CO_2; via monitors) to gain a proxy estimate of ventilation within a space and therefore estimate the risk of airborne transmission of pathogens such as *Mtb*. Importantly, data collected should be relayed quickly to an individual in a position to take action to improve ventilation in that space.

2. **Measure crowding**

   Methods to estimate crowding in particular spaces, with limits set on maximum occupancy for each space. This could be estimated through manual headcounts or (relatively cheaply) through the use of cameras and should be linked to a specific action if occupancy is above the stated limit. The group noted that any use of cameras required consideration of multiple issues around consent, privacy, and confidentiality.

3. **Identify potentially infectious individuals**

   Cameras could also be used to estimate risk of fever: they would detect some individuals with TB and may also detect individuals with other potentially infectious conditions. Once again, efforts would be needed to protect the identity of clinic attendees. Any such method would first require extensive engagement and discussion with patient groups and community representatives.

Strategies to modify waiting times and patient flow

Part I: Principles for strategies to reduce waiting times and improve flow

The group agreed that strategies to improve flow and reduce waiting times must align with existing policies around the organisation of care, in particular the Ideal Clinic recommendations[13] around classification of patients into 'Acute', 'Chronic', 'Preventative' and 'Health support' streams. It was suggested that any such strategy should manage expectations about likely impact and how long measures would take to have an effect; include the ability to react to data collected through waiting times surveys or other methods to estimate flow; be introduced to staff in a systematic and inclusive way, providing support and follow-up training; and be developed in collaboration with the community served by the facility (Table 3).

Table 3. Principles for designing strategies to reduce waiting times and improve patient flow in South African primary health care clinics

Characteristic	Requirements (A strategy should…)	Comments
Latency	…**balance** 'quick wins' against long-term benefits …**aim to effect lasting change** …**be articulated** clearly to stakeholders	A culture of prizing short-term gains was critiqued as non-sustainable. Short-and long-term goals should be identified and communicated to stakeholders in order to manage expectations.
Specificity	…**be data-driven** …**be designed to fit** patient preferences and behavioural patterns …**be adaptable to the clinic** size, population, climate, and culture	A strategy should be specific to local context. Built in should be opportunities for continued 'evolution' of the process based on results; this requires the use of a method to measure waiting times/patient flow that can be used at regular, short intervals.
Integration	…**be introduced** in a way that is sensitive, simple, and transparent …**prioritise safety** of health care workers …**be supported** by documentation, training, & oversight	A new initiative should be introduced into a clinic with consideration of its impacts on staff workload and safety. Clear communication to staff around intentions, roles, responsibilities, and expectations is critical, along with documentation and supportive oversight.
Realism	…**understand the limitations** imposed by the physical structures in which it is to be implemented …**account for** & include measures to minimise **staff resistance** …**align with budgets**	Certain actions are simply not possible in specific settings; these should be accounted for in planning and in evaluating success. Perceptions of 'extra work' may generate resistance to change; detailed and repeated consultation sessions with relevant staff must be carried out before commencing implementation.
Holism	…**aspire to improve** the overall delivery of health care …**be collaborative and interdisciplinary** …**encourage exchange of ideas** with the community	A strategy should align with the overarching goals of policy, the health system, and the health community. Critically, any strategy should be shaped by and amenable to the views and beliefs of the community served by that health facility.

Part II: Small group discussion

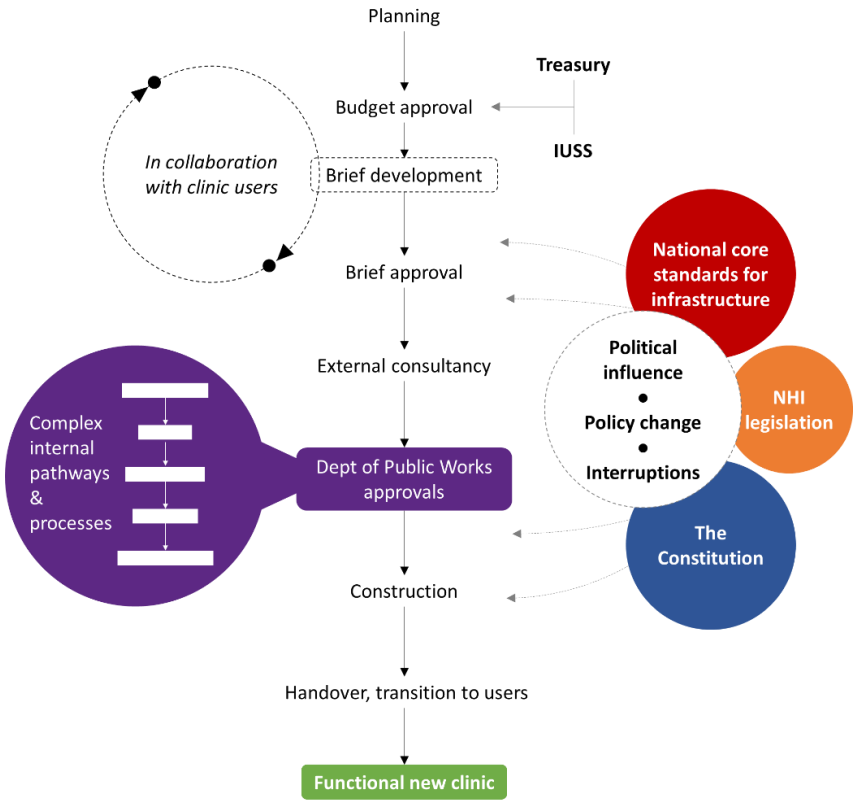
Discussion in the 'modifications' working group began with exploring some of the causes of overcrowding and went on to look at four areas in more depth: changes to physical structures, changing opening hours, queue management, and the introduction of appointment systems.

Creating and altering physical structures

The processes involved in making changes to buildings and of creating new buildings were explored in some detail. The process of building a new clinic is lengthy and convoluted, and it emerged that even 'simple' interventions were, in practice, more complicated to action.

The average from planning to final functionality for a new clinic is around 5–7 years (Figure 5) and involves multiple stakeholders and several stages of planning, consultation, and approval. Those responsible for clinic planning and design also try to account for long-term trends and changes in migration, demographics, and disease burden, which may lead to increased use of clinics in certain areas. A number of other 'higher level' factors have an influence on both the design process and the speed and direction of progress, including the country's constitution, national standards for infrastructure, major health-related legislation, and changes to health policy. There is also extensive collaboration with external parties (e.g., contractors, usually engaged through a competitive tender process) and between the Department of Health and the Department of Public Works; each has its own set of internal approvals. The number of steps and degree to which they affect the process of clinic-building vary by province, and depend to some extent on local governance.

Figure 5. Overview of steps and influences in building a new primary health care clinic



NHI: National Health Insurance; IUSS: Infrastructure Unit System Support

Making changes to an existing structure required many of the same approvals as creating a new structure. In part, these are safeguards to protect the structural integrity of clinic buildings and to ensure that any suggested changes have been examined by the relevant experts prior to their implementation. Making changes to a building while it is in use also adds complexity – one has to consider possible disruptions to care, impacts on staff safety and wellbeing, adding interim structures (e.g., park homes), and measures to temporarily shift services to other sites, which may be difficult due to transport limitations.

Altering opening hours

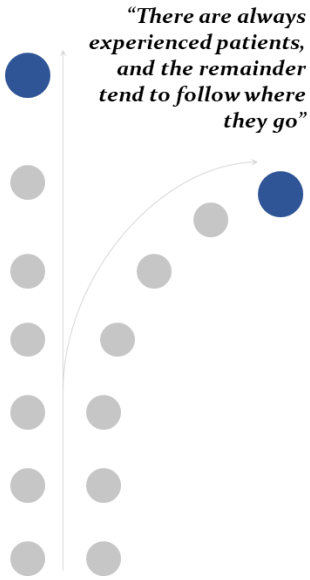
Parallels were drawn between the **use of space** and the **use of time**, with scope for increased efficiency in both domains. Making changes to the opening hours of clinics, to allow for attendance to be diffused throughout the day, was seen as difficult to implement. This was, in part, because of the entrenchment of work patterns in many parts of the service and the likely reluctance of staff to extend working hours, which is widely perceived to be of no tangible benefit to them.

The established pattern is for a "morning rush", with many patients arriving very early (sometimes as early as 0400 or 0500) and a great deal of activity from ~ 0700 to ~1300, after which clinics are relatively empty and staff under much less pressure. This was described as deeply rooted, and connected to wider societal issues, such as the community's trust in the health system overall. The availability of public transport in certain areas and national legislation around how public services should operate also limit the extent to which these times can be altered, and it was stressed that any measures should aim to protect staff from overly long shifts or overtime.

Accounting for the difficulties described above, approaches suggested included:

1. Seasonal adjustment of operating hours to minimise time spent waiting at very hot or very cold times of day (this also has implications for the ventilation of waiting areas, as doors and windows are less likely to be left open in these conditions to maximise the effects of the air conditioning or heating);
2. "Batching" patients to arrive at different times of day, based on staff availability;
3. Altering shift patterns to provide equal coverage with fresh staff in the afternoons (possibly through an incentive or reward system);
4. Accounting for the loss of afternoon 'down-time' by building in that time at other points in the day;
5. Staggering lunch breaks to allow for continuation of consultations throughout the day; and
6. Empowering facility managers to make changes to processes (and address staff concerns) based on their assessments and judgement.

Queue management



Using designated 'queue marshals' to manage crowding and improve flow was seen as unlikely to succeed, given previous failures and the lack of a specific cadre of health care worker to whom this responsibility could be assigned. Some clinics use non-clinical staff (such as security guards) to manage queues, but this was widely regarded as something that should be avoided. It was suggested that it may be useful to try to learn from the experiences of businesses (e.g., banks) and other public sector bodies (e.g., Home Affairs) that operate successful automated queue management systems.

A good queue management system was described as one that included clear signage and intuitive pathways around the building, required minimal active staff input, was adapted to the clinic's working patterns, and took account of patient preferences and behaviours (for example, that most patients like to be able to see the door of the room they are waiting to enter).

Appointment systems

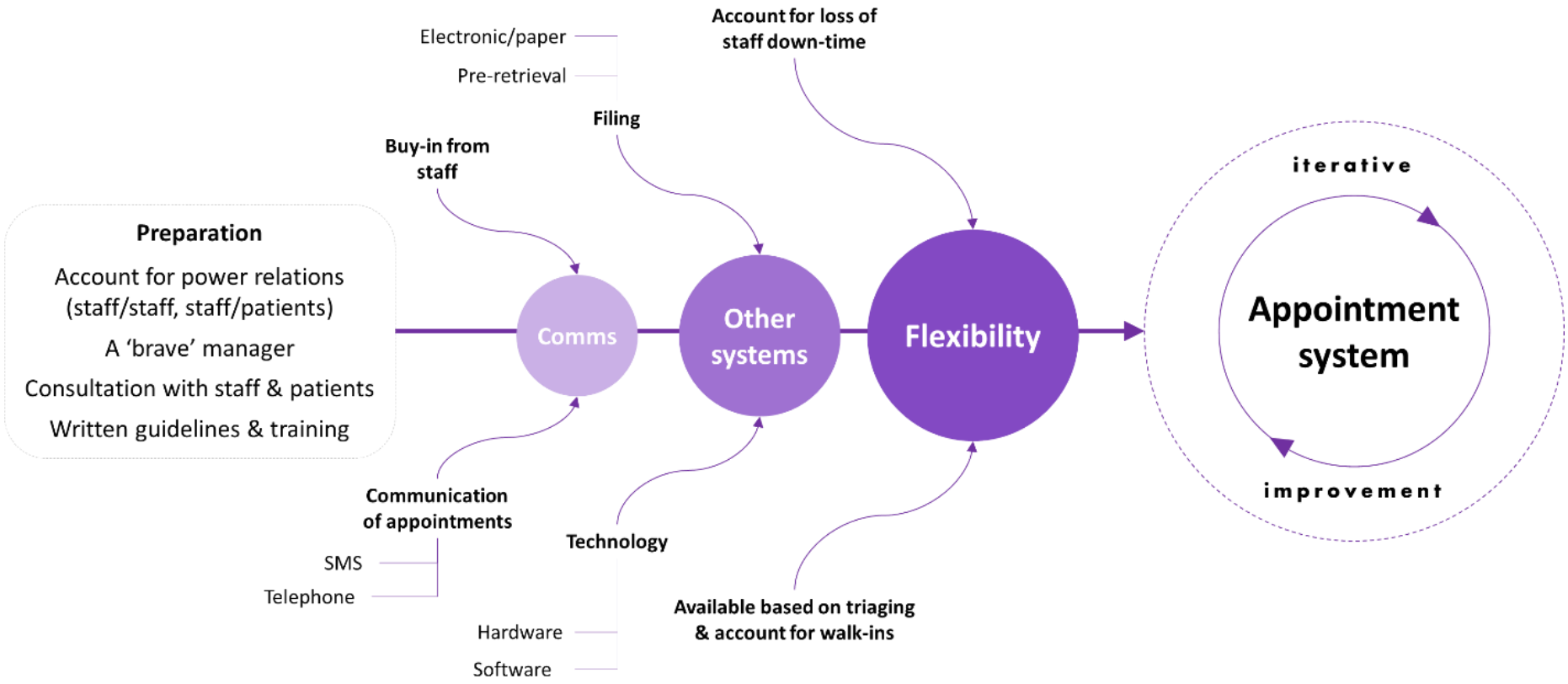
The initiative thought likely to have the biggest impact was to provide timed appointments to as many clinic attendees as possible. However, it was acknowledged that many had tried and struggled to do this in different parts of the country. The group discussed possible reasons for this lack of success ("*the system is very resistant to this intervention*"), describing the importance of the design of the appointment system (e.g., absence of built-in flexibility, lack of integration with other clinic processes, such as filing and triage), the resources and infrastructure needed to sustain them (e.g., computers, connectivity, specialist software, short message service [SMS] systems, additional administrative staff), the culture of the clinic into which they were introduced (e.g., staff resistance to perceived additional work, power differentials between staff and patients, the clinic's overall relationship with the community it serves), and the absence of adequate leadership in some facilities.

Participants who were facility managers shared their experiences of implementing appointment systems, describing the number and range of iterations and adjustments they had effected (sometimes over years) to get to a version of the system that worked for their clinic.

"If this is so obvious, why hasn't it already been done?"

The group outlined some of the steps required to design and establish a successful appointment system (Figure 6), emphasising the need for continuous evaluation and improvement. The outline of a generic appointment system, including stationery, is included in existing Ideal Clinic guidance.[13]

Figure 6. Overview of requirements and processes involved in developing and implementing an appointment system



Key conclusions and next steps

The participants of this co-design workshop agreed that many PHC clinics are overcrowded at certain times, that patients generally have to wait too long for services, and that clinic structures are often not fit for purpose, or are used in a way that is sub-optimal.

Current methods to measure waiting times are difficult and time-consuming, and generate data that, though useful for monitoring trends and evaluating the effects of large-scale interventions at district level and higher, are less useful at clinic level, in part because of time delays and issues with data flow. There is a need for a flexible 'diagnostic' method that does not require extensive planning or human resources to conduct, can easily be adapted to the circumstances of an individual clinic, and generates data that can be made available, quickly, to those working at the clinic to allow responsive changes to the organisation of care. Such a method could be derived from those that are already in use, though the approach most likely to be effective in the long term would involve investment in technological infrastructure and integration with other clinic systems, such as the filing system and, ideally, a queue management system.

Attempts to modify waiting times and flow must be designed with consideration of established relationships within the clinic and its working culture; the extent to which the facility manager is empowered and confident in making changes; power dynamics between the manager, staff, and patients; the history of and limitations imposed by the physical structure; and patient preferences. A system that gives most patients timed appointments is likely to be the most effective strategy, particularly if combined with an automated queue management system. Implementation, however, is complex, and initial attempts should expect to fail. Chances of success will be improved by an iterative, data-driven approach, and use of a system that can be easily adapted to changes in circumstances.

****

This report will be made available on the *Umoya omuhle* study website. The discussions and suggestions from this workshop are highly relevant to the objectives of the larger study, and the material gathered will be useful in shaping investigators' thinking around mechanisms that determine the efficacy, feasibility, and sustainability of interventions to reduce risk of TB transmission in PHC clinics. Pilot studies and operational research are needed to further evaluate effectiveness and implementation barriers. Giving facility managers the ability to easily measure waiting times and patient flow in their facilities, access the data collected, and take appropriate action is important not only for IPC but also for developing more efficient clinics and a learning health system.

Figure 7. Workshop participants

From left to right: Adrienne Burrough, Stamatia Katsikoyiannis, Peta de Jager, Gavin Reagon, Karin Diaconu, Nonjabulo Madide, Tobias van Reenen, Nolubabalo Fatyela, Marie Theunissen, Sibahle Vilakazi, Nonhlanhla Zikhali, Warren Caesar, Alison Grant, Yolanda Thambiran, Fikile Zungu, Shaidah Asmall, Aaron Karat (Photograph: Meghann Gregg)

Acknowledgments and funding

Translating from isiZulu as 'good air', *Umoya omuhle* is a 3.5-year project developing health systems interventions to improve IPC for DR-TB within health facilities in the Western Cape and KwaZulu-Natal provinces of South Africa. It is funded through the UK Economic and Social Research Council (Grant# ES/P008011/1), one of seven research councils underpinning the Antimicrobial Resistance Cross Council Initiative

We gratefully acknowledge additional support from The Bloomsbury SET (Research England; Project Grant BSA23).

Our thanks also to the Salt Rock Hotel, Salt Rock, KwaZulu-Natal, South Africa.

References

1 World Health Organization. WHO policy on TB infection control in health-care facilities, congregate settings, and households. 2009. http://www.ncbi.nlm.nih.gov/books/NBK179249/ (accessed 2019 Dec 1)

2 Reagon G, Igumbor E. Strengthening Health Systems through training of Health Care Providers in the conduct of Routine Waiting Time and System Efficiency Surveys. *Stud Health Technol Inform*. 2010;590–594.

3 Bachmann MO, Barron P. Why Wait so Long for Child Care? An Analysis of Waits, Queues and Work in a South African Urban Health Centre. *Trop Doct*. 1997;**27**(1):34–8.

4 South Africa National Department of Health. Draft National Guideline for Management of Patient Waiting Times at Health Facilities. 2019. https://www.idealhealthfacility.org.za/docs/guidelines/Draft%20National%20Guideline%20to%20Manage%20Patient%20Waiting%20Times%20in%20Health%20Facilities%20Jan%202019.docx (accessed 2020 Jul 2)

5 Sokhela DG, Makhanya NJ, Sibiya NM, Nokes KM. Experiences of Fast Queue health care users in primary health care facilities in eThekwini district, South Africa. *Curationis*. 2013;**36**(1):8 pages.

6 Singman EL, Haberman CV, Appelbaum J, et al. Electronic Tracking of Patients in an Outpatient Ophthalmology Clinic to Improve Efficient Flow: A Feasibility Analysis and Benchmarking Study. *Qual Manag Health Care*. 2015;**24**(4):190–9.

7 Almomani I, AlSarheed A. Enhancing outpatient clinics management software by reducing patients' waiting time. *J Infect Public Health*. 2016;**9**(6):734–43.

8 Higginson I. Emergency department crowding. *Emerg Med J*. 2012;**29**(6):437–43.

9 Yates TA, Khan PY, Knight GM, et al. The transmission of Mycobacterium tuberculosis in high burden settings. *Lancet Infect Dis*. 2016;**16**(2):227–38.

10 Churchyard G, Kim P, Shah NS, et al. What We Know About Tuberculosis Transmission: An Overview. *J Infect Dis*. 2017;**216**(suppl_6):S629–35.

11 Kielmann K, Karat AS, Zwama G, et al. Tuberculosis infection prevention and control: why we need a whole systems approach. *Infect Dis Poverty*. 2020;**9**(1):56.

12 Zamenopoulos T, Alexiou K. Co-design as collaborative research. 2018. https://connected-communities.org/wp-content/uploads/2018/07/Co-Design_SP.pdf (accessed 2020 Jul 2)

13 South Africa National Department of Health. Ideal Clinic Integrated Clinical Services Management Manual. https://www.idealhealthfacility.org.za/docs/Integrated%20Clinical%20Services%20Management%20%20Manual%205th%20June%20FINAL.pdf (accessed 2010 Jul 2)

14 Ngcobo P. Researching the transmission of drug-resistant TB in South Africa's clinics. 2019. https://www.ahri.org/researching-the-transmission-of-drug-resistant-tb-in-south-africas-clinics/ (accessed 2020 Jul 2)

Appendices

Appendix I. Participants and affiliations (listed by surname)

Name	Title & affiliation
Shaidah Asmall	Senior Technical Adviser, National Department of Health, Pretoria, South Africa
Adrienne Burrough	Project Manager, London School of Hygiene & Tropical Medicine, London, UK
Warren Caesar	Facility Manager, DuNoon Community Health Centre, Cape Town, South Africa
Karin Diaconu	Research Fellow, The Institute for Global Health and Development, Queen Margaret University, Edinburgh, UK
Nolubabalo Fatyela	Operational Manager, Town Two Clinic, Cape Town, South Africa
Alison Grant	Professor of International Health, TB Centre, London School of Hygiene & Tropical Medicine, London, UK
Meghann Gregg	Research Fellow, London School of Economics and Political Science, London, UK
Peta de Jager	Research Group Leader, Smart Places Cluster, Natural Resources, Enabling Infrastructure, Professional and Public Services Division, Council for Scientific and Industrial Research, Pretoria, South Africa
Aaron Karat	Research Fellow, TB Centre, London School of Hygiene & Tropical Medicine, London, UK
Stamatia Katsikoyiannis	Chief Architect, KwaZulu-Natal Department of Health, Pietermaritzburg, South Africa
Karina Kielmann	Reader, The Institute for Global Health and Development, Queen Margaret University, Edinburgh, UK
Nonjabulo Madide	TB survivor and patient advocate, KwaZulu-Natal, South Africa
Hayley McGregor (remote)	Research Fellow, Institute of Development Studies, University of Sussex, Brighton, UK
Gavin Reagon	Public Health Practitioner, Western Cape Department of Health, Cape Town, South Africa
Tobias van Reenen	Senior Researcher, Council for Scientific and Industrial Research, Pretoria, South Africa
Yolanda Thambiran	Health Planner, Infrastructure Development, KwaZulu Natal Department of Health, Pietermaritzburg, South Africa
Marie Theunissen	TB Survivor; IMPAACT network; Adherence Monitor, FAM-CRU CTU, Stellenbosch University and Department of Paediatrics and Child Health, Tygerberg Hospital, Cape Town, South Africa
Sibahle Vilakazi	Chief Executive Officer, Nseleni Community Health Centre, Nseleni, South Africa
Nonhlanhla Zikhali	Operational Manager, KwaMsane Clinic, KwaMsane, South Africa
Fikile Zungu	Manager: Operations Coordination, King Shaka International Airport, Durban, South Africa

Appendix II. Workshop programme

Participatory workshop on measuring and modifying patient flow and waiting times in South African Primary Health Clinics

Thursday, 08 August 2019 | Salt Rock, KwaZulu-Natal

Aim

To bring together experts in measurement and modification of waiting time, physical space, person movement, primary health care policy, primary health clinic operations, and infection prevention & control to share knowledge and perspectives around measuring and modifying patient flow in South African primary health clinics and to develop methods to assess and improve flow in these settings.

Objectives

1. To facilitate discussion/create a space for exchange of ideas +/- create a 'reference group' for future similar discussions/publications
2. To design rapid assessment tool/s to assess waiting times, flow, and crowding in South African primary health clinics (PHCs)
3. To devise simple short- and long-term strategies to reduce crowding/improve flow in PHCs (ideally implementable by facility managers and/or other health care professionals)

Programme

0830–0840	*Coffee*; Welcome and introductions
0840–0850	Discussion of workshop objectives
0850–0900	Presentation of data collected during the Umoya omuhle study
0900–0945	**Discussion 1:** Measuring waiting times, patient flow, and crowding
0945–1045	**Discussion 2:** Strategies to reduce waiting times and improve flow
1045–1100	**Discussion 3:** Review of Discussion 1 in light of Discussion 2
1100–1115	*Coffee*
1115–1245	**Group work:** Group 1 measurement and Group 2 modification
1245–1330	*Lunch*
1330–1430	**Review:** assessment tools
1430–1530	**Review:** improvement strategies
1530	*Coffee and close*