SAFE AIR NOW

Protecting healthcare workers and patients from TB and other airborne pathogens







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A note on imagery

This report was produced by a research team based in the United Kingdom. The photographs used in this report are largely drawn from stock image libraries unless provided by case study partners. Given the subject matter and density of text, the authors feel the inclusion of these images nonetheless contribute much needed humanity to an otherwise technical discussion. All photo subjects confirmed their consent to be photographed in line with robust requirements set out by the stock image library or case study partners.

Other Resources

Want to learn more about airborne IPC, and TB IPC in particular? You can find helpful resources and further reading by visiting the following pages:

- End TB Transmission Initiative –
 Powering Airborne IPC | Stop TB
 Partnership Working Group
- <u>EWTB Exemplars</u>
- <u>TB Proof</u>
- WHO Guidance

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OVERVIEW OF RECOMMENDATIONS

Our report has identified six key recommendations that would dramatically strengthen infection prevention and control (IPC) and keep healthcare workers, and their patients, safe from the risk of TB and other airborne diseases in healthcare facilities.

Recommendation 1

Mainstream (airborne) IPC as a quality-ofcare and prevention issue within national, regional, and global governance and accountability forums, including multisectoral accountability frameworks, World Health Assembly reporting and the 2027 UN High-Level Meeting on TB.

Recommendation 2

Include airborne IPC as a priority pillar in national IPC Action Plans, PPPR and UHC frameworks, and ensure sufficient prioritisation of airborne IPC in global and regional IPC discussions.

Recommendation 3

Strengthen national and local IPC and occupational health programmes, including through the allocation of earmarked budgets and appointment of empowered leaders, focusing on areas for action highlighted in this report.

Recommendation 4

Strengthen national IPC policy frameworks, regulations, and systems, including through closer collaboration with relevant ministries, professional bodies, and the private sector.

Recommendation 5

Enable greater IPC innovation by supporting implementation and real-world assessment of novel tools and strategies with 'strong enough' evidence base.

Recommendation 6

Invest in proactive stigma-reduction plans and campaigns, targeting both the general public and healthcare workers in particular.



INTRODUCTION

Today, over 65 million people earn their living as healthcare workers (Boniol et al., 2022). We all rely on their expertise, skills and professionalism to stay healthy and working, and their efforts are core to the delivery of the Sustainable Development Goals (SDGs).

This work comes with risks. The COVID-19 pandemic demonstrated the dangers faced by healthcare workers in the harshest of ways. Healthcare workers all over the world put themselves in harm's way to save lives and too many lost their own in the process.

In the absence of an effective vaccine being widely available, traditional infection prevention and control measures (IPC) are critical to minimising the spread of disease, particularly in settings where people who are unwell go to receive care. COVID-19 also demonstrated that many countries were not able to implement adequate IPC measures, especially in the context of an airborne pathogen (Cook et al 2023).

Transmitted through tiny droplets suspended in the air after someone coughs, speaks or breathes, COVID-19 spread unseen through the air. Airborne pathogens can quickly cause pandemics, transmitting in places where few people think they need to protect themselves from infection (Adalja et al 2019). But airborne transmission is not unique to COVID-19, and there are a multitude of other pathogens that can spread this way.

Tuberculosis (TB) is one such pathogen. While less infectious than SARS-CoV-2, TB kills more people than any other infectious disease each year. In countries with a high incidence of TB, healthcare workers are at particular risk, coming into regular contact with people with active TB disease before they have been diagnosed and enrolled on treatment. In the absence of proper airborne IPC including triaging, separation or isolation, maximised ventilation, and the use of respirators, many healthcare workers are left exposed.

This scenario is all too common, with catastrophic and sometimes fatal consequences for the individuals concerned, as well as the patients who rely on them. For the health system, occupational TB represents a failure of local IPC procedures, national policies, training, and enforcement, and reflects the inadequate prioritisation of IPC and occupational health, not just for TB, but for all airborne pathogens - known and unknown.

The Ending Workplace TB initiative (EWTB) was founded to facilitate private sector companies to end TB within their workforces, supply chains and the communities in which they work. While some of our members employ healthcare workers themselves, every EWTB member organisation relies on healthcare workers to keep their workforces safe.

Governments around the world committed to accelerate action on TB and Pandemic Prevention, Preparedness and Response (PPPR) during the 2023 United Nations General Assembly. During the 2024 World Health Assembly, a new Global Action Plan on IPC was launched (WHO 2024). This provides a unique opportunity to ensure protecting healthcare workers from airborne pathogens is properly prioritised.

With this aim, this white paper consolidates recommendations, data, and examples of best practice on IPC and occupational health, and makes recommendations to governments, providers and advocates. It provides a tool for EWTB members and partners who want to keep the healthcare workers they employ safe, and those who want to advocate for bolstering airborne IPC to protect us against all airborne pathogens.

Case Study: Surviving Occupational TB

I was diagnosed with TB in my final year of medical school in Ethiopia. At the time, the hospital did not even have consistent access to running water let alone respirators and sanitizers, so there were no IPC arrangements for medical students.

Because I was at the hospital for work, I was quickly diagnosed and enrolled in treatment. But when my condition didn't improve, the local doctors tried their best but couldn't help. In the end, I had to travel more than 300 km to Addis Ababa, the capital, where I was eventually diagnosed with MDR-TB. In total, I spent over 4 years on treatment.



This was a really difficult time in my life, and I am forever grateful to my family, friends and colleagues for their support. I found the role reversal from caregiver to patient challenging, and battled with depression, low self-esteem, and isolation. I also faced stigma from other healthcare workers, particularly those who were scared of contracting MDR-TB themselves in the absence of proper IPC.

The COVID-19 pandemic was a scary time for me because the scarring on my lungs makes me especially vulnerable, but I'm proud to say I never stopped working. The last few years have also had some positive effects, with much greater recognition of airborne IPC. Hospitals have bolstered their IPC committees, and there's greater access to PPE.

Together with TB PROOF, I am now using my voice to advocate for strengthened IPC in health institutions and the development of shorter TB treatment regimens. If we can give even a fraction of the attention we gave to COVID-19 to TB, I'm sure we can get rid of this deadly disease for good - and protect ourselves from other airborne pathogens at the same time!

Wubshet Jote Tolossa (Dr.)

Tuberculosis: The Airborne Killer

Tuberculosis is spread almost exclusively through airborne particles, generated when an infected person coughs, speaks or laughs. Because the bacterium needs to be breathed deep into the lungs to infect a new person, it is rarely spread through other forms of contact.

TB particles can be suspended in the air for up to 6 hours, but the greatest risk of infection occurs when someone has been exposed for a prolonged period of time in poorly ventilated spaces, such as crowded homes, prisons and healthcare facilities (Nardell, 2016).

Depending on their living and working conditions, and the nature of their symptoms, there is significant variation in how many people a person with active TB disease will pass the infection on to (Ma et al., 2018; Emery 2023). With many people with TB still facing unacceptable delays in accessing proper diagnosis and treatment, they may visit a healthcare facility multiple times without knowing that they are spreading the infection (Chu-Chang et al., 2020; Oga-Omenka et al., 2020; Chakrabartty et al., 2019).



AN INTRODUCTION TO IPC AND OCCUPATIONAL HEALTH

"A safe and healthy work environment is fundamental to decent work and a key element of human dignity" - World Health Organization & International Labour Organization (2020)

A wealth of data highlights the dangers faced by healthcare workers. Rates of TB infection (previously referred to as 'latent TB infection') are thought to be 25 times higher for healthcare workers than for the general population, and in South Africa, healthcare workers have been found to be 5 times more likely to be hospitalised with multidrug-resistant TB (Baluku et al 2023; WHO 2022). During the 2014 outbreak of Ebola Virus in West Africa, the risk of infection among healthcare workers was 21 to 32 times higher than in the general population (Mohamud et al 2023). Healthcare workers are also known to suffer from high rates of occupational burnout, with workplace injuries and illnesses costing health systems billions of dollars a year (WHO 2023).

Almost all of these statistics are at least partially avoidable. This would, clearly, be of great benefit to the healthcare workers, but also carries a benefit for patients. We know that the conditions that place healthcare workers at risk also impact on the quality of healthcare services that they deliver, and in turn, patient outcomes (WHO 2023). This is both a contravention of the rights and dignity of the individual healthcare worker, but also a major barrier to the delivery of the Sustainable Development Goal agenda, particularly in the context of immense workforce shortages (WHO 2020).

Strengthening infection, prevention and control (IPC) and offering robust occupational health services for those who become ill as a result of their work is thus critical to meeting employer obligations, ending TB and increasing access to essential health services.

Minimum requirements for Infection Prevention and Control (IPC)

IPC is about minimising the risk of transmission of an infectious agent within a particular setting. It is especially critical in healthcare facilities, where patients are vulnerable to healthcare acquired infections (HAIs) and healthcare workers may be exposed to a significant number of pathogens.

The World Health Organization (WHO) sets out a range of minimum requirements for effective IPC programmes in healthcare settings across primary, secondary, and tertiary care (WHO 2019). These include robust policies, training programmes, standard occupancy and staffing levels, sufficient infrastructure, multimodal strategies to aid implementation of IPC guidelines, surveillance of HAIs, and robust monitoring, audit and feedback.

Airborne IPC

Additional guidance is provided to minimise the risk of transmitting different types of infectious agents. For airborne agents, including TB, these include:

1) Administrative Controls

Administrative controls refer to processes and procedures which minimise contact between people who may be generating infectious aerosols and healthcare workers and other patients. For TB, such procedures include:

- Triage of people with TB signs and symptoms, or with TB disease
- Respiratory separation or isolation of people with infectious TB disease
- Prompt initiation of effective TB treatment of people with TB disease

2) Environmental Controls

Environmental controls refer to adapted infrastructures which reduce the concentration of infectious droplets in the air and on surfaces. For TB and other airborne pathogens, such infrastructures include:

- Natural ventilation (e.g. windows and open buildings)
- Mechanical ventilation
- Upper-room germicidal ultraviolet systems
- Dedicated isolation facilities (e.g. negative pressure rooms)
- Work- and patient-flow mapping to minimise transmission hotspots

3) Transmission-based controls

Transmission-based controls refer to the processes, procedures and tools which minimise the risk of infectious particles being transmitted to an uninfected person. For airborne pathogens like TB, this can be achieved through advanced respiratory protection programmes, including:

- Wearing certified N95/FFP2 respirators
- Performing regular respirator fit testing and seal checks
- Performing hand hygiene before and after the use of respirator
- Instructing patients to wear a medical mask and follow respiratory hygiene and cough etiquette

Occupational Health

Occupational health is both about protecting healthcare workers from harm through robust IPC systems and supporting them to recover quickly in the event of any workplace acquired illnesses.

Guidance on occupational health in TB is limited, however, the following core provisions are often recommended:

- A national programme on occupational health: specific policies, procedures, funding, and monitoring to protect the health, safety, and well-being of healthcare workers, with robust linkages to relevant programmes and services (WHO 2023: WHO & ILO 2020).
- 2) Screening for active TB disease: regular screening of healthcare workers to ensure early detection, particularly in high TB burden contexts where the risk of exposure is high and in facilities treating patients especially vulnerable to TB (WHO 2021).
- 3) Treatment and support: In the event of a TB diagnosis, rapid enrolment on TB treatment, appropriate sick leave provisions and psychosocial support to enable healthcare workers to complete treatment, recover and return to work.
- 4) TB infection screening and preventive treatment: In low TB burden settings, occupational health services may choose to screen healthcare workers for TB infection and offer preventive treatment, if appropriate.
- 5) Stress and psychological well-being: Appropriate staffing and workload levels, sufficient supervision, training, ensuring staff feel valued and have time to rest, and providing access to professional psychological support where needed (WHO 2023: WHO & ILO 2020)

Towards a broader definition of health workers

It is not just doctors and nurses who are at risk of contracting and passing on TB in the course of their duties. In fact, other staff working in healthcare facilities are often at greatest risk of TB because the policies and processes to protect them have not been prioritised.

It's crucial that IPC and occupational health arrangements consider the needs of all other workers involved in running healthcare services, including:

- Community health workers and volunteers
- Receptionists and other administrative staff with patient-contact
- Porters
- Cleaning staff
- Medical students and trainees
- Subcontractors

Case Study: Kyrgyz National Reference Laboratory

Staff working in laboratories are often at heightened risk of contracting occupational TB, due to their regular handling of live, infectious samples. The Kyrgyz Republic has one of the highest rates of drug-resistant TB in the world. On average, every third TB patient tested by the National Reference Laboratory results in either multi- or extensively- drug-resistant TB.

Over the last decade, the National TB Reference Laboratory has worked to strengthen its biosecurity protocols, including for Infection Prevention and Control. This included the development of a range of new policies and standard operating procedures, a training curriculum (including regular refresher training) and an internal quality management system to identify, investigate and respond to any transmission risks. Donor funding enabled the eventual construction of the state-of-the-art BSL-3 laboratory building, which was accredited according to the ISO 15189 standard in 2021. This makes it the most advanced laboratory in the country and a critical component of the Kyrgyz National TB Program.

Dr Kalmambetova, who leads the laboratory, is proud to report that no colleagues have contracted TB since the BSL-3 lab was constructed and quality improvement project began in 2013. In the previous years, it was usual to see at least one or two laboratory technicians fall ill. She emphasizes that the most advanced infrastructure is of little use if staff are not properly trained and managed, and notes that the laboratory's good reputation has enabled her to recruit a young, ambitious, and well-trained workforce. The team is now working with the National TB Programme to deliver IPC training to healthcare workers, including nurses who work in primary care and are known to be at highest risk of TB exposure.



Understanding TB infection

Once particles containing viable Mycobacterium tuberculosis reach an uninfected person's lung alveoli in sufficient quantities, the person may develop something called 'TB Infection'. This means that while the bacterium is in the person's body, it has not spread sufficiently to cause active and infectious TB disease (Pai et al 2016).

Because of their frequent exposure to people with active TB disease and limited access to quality IPC, approximately 54% of healthcare workers in low- and middle-income countries have a TB infection (WHO 2022). This rate is 25 times higher than among the general population.

It is estimated that between 5 - 10 % of people with TB infection will go on to develop active TB disease (WHO 2020). The risk of 'converting' is heightened in the first year after being infected and when the immune system is weakened by other conditions, such as HIV, diabetes, and malnutrition, making the overall wellbeing of an individual healthcare worker a crucial component of preventing occupational TB.

Information on TB preventive treatment for healthcare workers is presented below.



Understanding Subclinical TB

It is thought that around one half of people with bacteriologically confirmed TB do not experience any of the traditional symptoms associated with TB, including coughing, weight loss and night sweats. There had long been the assumption that individuals with so-called 'sub-clinical TB' did not spread the infection, but emerging evidence is laying question to this claim.

A recent study found that subclinical TB "likely contributes substantially to transmission in high-burden settings", particularly when taking into account the increased diagnostic delay for people without standard symptoms (Emery et al 2023).

From an IPC perspective, subclinical TB is particularly concerning as in the absence of symptoms, people with subclinical TB are unlikely to be picked up by triaging and isolation arrangements. This is similar to COVID-19, where transmission can also occur in the preclinical stake. This emphasises the importance of robust airborne IPC which employs multiple strategies across congregate healthcare settings.

Minimum requirements for IPC

The most recent WHO report on global IPC painted a startling picture, with only around half of countries reporting an active IPC programme and only four countries meeting all minimum requirements for IPC (WHO 2022). Performance was closely matched to a country's wealth, with high-income countries eight times as likely as lowincome countries to have an advanced IPC implementation status. Not a single facility in a low-income country met all the minimum requirements. Notably, there has also been little to no improvement in global IPC standards between 2018 and 2021, reflecting insufficient prioritisation of the IPC agenda despite increased focus on health systems strengthening (WHO 2022).

TB specific data shows that national TB programmes do tend to have IPC policies in place, and many TB services will have translated these into local guidance and/or have a person or group of people who are responsible for their implementation (Islam et al 2021; Baluku et al 2023). During the pandemic, the most advanced TB wards were often turned into COVID-19 wards due to their comparatively advanced airborne IPC arrangements (CGH 2023). In the Kyrgyz Republic, rates of COVID-19 among healthcare workers are reported to have been almost 4 times lower in MDR-TB wards than other units. Nonetheless, the level of practical implementation of these policies is variable, with surveys consistently finding low levels of training and awareness among staff, patchy implementation of guidance, and poor infrastructure (Baluku et al 2023; Van Der Westhuizen et al 2022; Barai & Koirala 2022; Islam et al 2022; Colvin et al 2020; Islam et al 2021; Kuyinu et al 2019; Tan et al 2020). This was echoed by key informants, who noted there was often an enormous gulf between policy documents and real-world practice.

A frequent barrier highlighted in both the academic literature and in key informant interviews was around staff training and culture. Insufficient training during basic medical education has prompted private providers to develop independent curriculums to upskill new recruits during onboarding, while the absence of adequate refresher training in the public sector is linked with poor levels of knowledge and false perceptions of risk (Masuku et al 2023; Van der Westhuizen 2022; Islam et al 2022; Islam et al 2021; Tan et al 2020). Key informants described how placement on TB wards, often perceived to be higher risk, is sometimes used as a disciplinary measure, resulting in a poor workplace culture and undermining teamwork. Numerous articles describe how IPC leadership roles rarely contribute to career progression and so were often allocated to junior staff, with insufficient experience, knowledge, or power to drive change (Colvin et al 2020; Fadare et al 2020).

It is worth noting that the vast majority of the scholarship in this space focuses on government funded healthcare. Standards vary significantly in the private sector, where larger, higher-end private sector providers view IPC as a critical business priority – both in terms of reputational management vis-à-vis potential customers and to minimise the costs associated with occupational illnesses among employees. While this has resulted in significant investment in leadership, in-house training, and infrastructure by some providers, it is important to recognise that in the absence of comprehensive policies, robust enforcement, and proper implementation support, this has not translated to the lower end of the market where smaller, independent and underregulated service providers are often the first port-of-call for people who develop respiratory symptoms (WHO 2021).

Private providers interviewed for this paper also highlighted that they rarely operate TB-specific services, integrating TB diagnosis and treatment into general or respiratory services. Many noted that the prevalence of TB is comparatively low due to the higher socioeconomic status of many of their patients but recognised there was still a transmission risk. particularly from patients that had not yet been screened or diagnosed. This has led to many taking a more integrated approach to airborne IPC, with measures in place across waiting facilities, consultation rooms and wards, mitigating against the risk of airborne transmission of any pathogen - be it TB, influenza or COVID-19.

This is distinct from the literature on government-sector health services, where much of the evidence suggests that airborne IPC is strongest in in-patient TB wards and is rarely considered a priority by primary and general healthcare facilities (Colvin et al 2020; Tan et al 2020; Van der Westhuizen et al 2019). With considerable evidence of patients presenting to care multiple times prior to receiving a TB diagnosis, and an increased focus on decentralising care for people with TB, this means there is significant risk of transmission of TB and other airborne pathogens outside specialist TB wards (Van der Westhuizen 2022; Chu-Chang et al., 2020; Oga-Omenka et al., 2020; Chakrabartty et al., 2019)



AMR and IPC

Antimicrobial resistance (AMR) has become a major global health threat, undermining our ability to treat a whole range of deadly infectious diseases. Drug-resistant TB is currently one of the leading causes of AMR-associated deaths, having become so prevalent that the majority of cases are now transmitted rather than acquired following failed treatment with first line drugs (WHO 2023). Nosocomial transmission of DR-TB has been well documented and is a growing concern in the context of high rates of DR-TB and barriers in accessing rapid diagnosis and novel treatment regimens (WHO 2023).

However, airborne IPC is not just relevant to preventing the spread of DR-TB, with growing recognition of the potential spread of other antimicrobial resistant pathogens through airborne or droplet transmission (Wu et al 2022; Jin et al 2021; Solomon et al 2017). Indeed, many lessons can be learned from TB in trying to prevent the spread of AMR (Cegielski et al 2021).

Later this year, world leaders will be meeting at the United Nations for a second high-level meeting on antimicrobial resistance, offering a critical opportunity to prioritise IPC and airborne IPC as part of this global agenda.

Administrative Controls

This often translates to inconsistent implementation of administrative IPC like triage and airborne isolation in both waiting areas and general and outpatient wards, as well as delayed testing and initiation of effective treatment. When primary care facilities do consider airborne IPC, practice is often centred around mask wearing and natural ventilation in consultation rooms (transmission and environmental controls), with insufficient attention around cough triage, waiting room management or early diagnosis and treatment initiation (Colvin et al 2020; Evans & Bekker 2016). Key informants described how even those leading TB-specific services often didn't sufficiently consider patient flow when planning workflows and staffing arrangements, leading to entirely preventable transmission hot spots.

Aside from local policy, training and cultural barriers, insufficient space and human resources are also frequently highlighted as key hurdles to effective administrative IPC (Islam et al 2021). With heavily oversubscribed health services and chronic workforce shortages, medical staff often don't have the capacity to provide patient care while also managing overcrowded waiting rooms to triage and isolate patients with respiratory symptoms, let alone lead complex service reconfigurations.

While human resource constraints are less of a concern in the private sector, which is usually able to attract and retain employees more easily, many providers noted that administrative controls were restricted by the built environment. Few providers, for example, reported having separate waiting rooms for patients with respiratory symptoms or wards for TB patients only and some noted that the more modern buildings they occupy often don't allow for natural ventilation. Instead, they rely on triage, minimising time spent in waiting areas through appointment systems and employing other environmental and transmission-based controls while patients are in congregate settings.

Environmental controls

Some private healthcare providers reported having state of the art isolation facilities for patients diagnosed with active TB disease, including negative pressure isolation facilities, particularly in purpose built occupational health facilities for highrisk workforces, including in the extractive industries. More broadly, private sector providers operate in facilities with varying environmental controls. Most facilities have some form of natural ventilation or mechanical ventilation in place, with more advanced ventilation like HEPA filters and negative pressure rooms in inpatient facilities. This, in combination with transmission-based controls, was generally deemed sufficient for IPC risk management because the total number of patients with suspected TB was comparatively low, as was the time spent within facilities given more advanced appointment systems.

In the public sector, where caseloads are greater and appointment systems less common, the quality of environmental controls also varies greatly. While purpose-built facilities will often have implemented low-tech solutions like placing waiting rooms and corridors in roofed, outdoor areas to allow good airflow, this is less possible in the vast majority of facilities that were constructed without airborne IPC as a core consideration (WHO 2023). Key informants noted that exciting new tools, including Upper Room Ultraviolet Germicidal Irradiation and carbon dioxide monitors to monitor ventilation rates in a space had become significantly more accessible over recent years, creating scope for more robust and consistent environmental IPC even in low resource settings.

Case Study: Working in Partnership to Strengthen IPC during COVID-19

The Tropical Health Education Trust (THET) is a UK-based charity that provides training and education for healthcare workers in Africa and Asia, working in partnership with health providers and volunteers from across the UK. The THET team are very familiar with the lack of adequate IPC across health services in LMIC contexts and sprang into action when the emergence of COVID-19 put healthcare workers at increased risk.

Initiatives included the Brighton-Lusaka Pharmacy Link, which enabled the Lusaka University Teaching Hospital in Zambia to set up an in-house facility to produce alcohol-based hand rubs to WHO standards. Providing an alternative to handwashing facilities for staff before and after patient contact and during the donning and doffing of PPE, the in-house facility produced some 200 litres of hand rub per day to meet all the hospital's requirements during the peak of the COVID-19 pandemic.

The pandemic also prompted a much greater appreciation of the risk of airborne transmission among healthcare workers in non-TB services across Africa and Asia, including anaesthesia providers and those working in obstetrics and gynaecology. Working together with local and international partners, THET worked to establish local production of quality PPE and provided training to staff about their proper use in a number of countries.

In Uganda, an ongoing partnership has worked to strengthen IPC at the Mulango National Referral and Teaching Hospital. Having secured support from both the senior directorate and the Ministry of Health, the team has been able to drive significant behaviour change, with IPC resources now given greater priority in procurement and the hospital IPC and antimicrobial stewardship committees increasing the generation and review of data, sharing information, and formalising decision-making processes. Thanks to this senior leadership, the team is confident that these practices will be sustained beyond the end of grant funding.





Transmission based controls

The culture of mask wearing was altered fundamentally as a result of the pandemic, with greater knowledge about the value of mask wearing, which masks to wear when and how, and also increased global supply following an initial period of stock outs. Private providers reported more stringent regulations around mask wearing following the pandemic, including regular spot-checks by senior leadership, communication campaigns targeted at patients, and the development of bigger stockpiles of quality assured respirators. In some cases, this has also been driven by relevant accreditation schemes, which assess mask wearing compliance as part of their evaluations.

In the public sector, the pandemic also impacted mask wearing but key informants described a noticeable shift to business-as-usual in many facilities where investment in leadership, communication, workload management, and enforcement had not kept pace. Studies have consistently shown limited use of appropriate respirators by healthcare staff, with little or only 'performative' use of personal protective equipment when managers or international visitors attended clinics (Kallon et al 2021; Colvin et al 2020; Baral et al 2022; Kuyinu et al 2019; Loibner et al 2019). Culture is critical in this context, with literature and key informants noting how younger staff often arrive on wards feeling invincible, staff questioning the relative level of risk in healthcare facilities when rates in the community are also high, and others concerned that their wearing a mask would infer they are at higher risk of TB due to their HIV status (Kallon et al 2021; Islam et al 2021; Chugtai & Khan 2020; Colvin et al 2020). Key informants emphasised real barriers to culture change in this space, in part because of limited awareness of occupational TB among non-HIV-positive colleagues.

Others noted that excessive workloads also undermined the use of PPE, with insufficient time to conduct fit tests, regularly replace masks, perform seal checks and safely take comfort breaks in non-patient care spaces leading to staff wearing masks incorrectly, not changing masks sufficiently, or giving up altogether. While task shifting and workload issues are no doubt part of the solution for this problem, others noted that there also needed to be a cultural shift away from IPC being seen as an obstruction to clinical care, as opposed to a critical component of quality care (Van der Westhuizen et al 2022).

Occupational health

Regardless of whether in the public or private sector, large healthcare providers tend to conduct some form of health screening for new employees, have an occupational health service in place, and provide some level of income protection for staff needing to take time off due to a workplace acquired illness. However, the quality of these services and the frequency of check-ups is highly variable, with high-end, high-income private providers conducting standardised annual check-ups whereas public services in poorer countries often rely on health workers recognising their symptoms themselves, seeking care and, in some cases, being able to demonstrate they contracted the infection through work. Screening for subclinical or asymptomatic TB is rarely done. Occupational health provision is even poorer or non-existent for healthcare workers employed by smaller, independent providers or subcontractors. This may delay diagnosis and treatment considerably, and increase the chance of healthcare workers passing an infection on to vulnerable patients.

The stigma associated with a TB diagnosis, and any associated HIV status, was frequently flagged by key informants as a barrier to care seeking behaviour among public-sector healthcare workers. This stigma can be social, but also driven by employment policies which make healthcare workers fear for their jobs if they disclose their TB status. Once informant described instances where healthcare workers would travel to occupational health facilities in other districts to avoid gossip in their own workplaces. Similarly, the significant selfstigma associated with the shift in role from clinician to patient is particularly challenging for many healthcare workers who have contracted occupational TB.

Relatedly, key informants noted that the mental health and wellbeing of healthcare workers was a dangerously neglected agenda. While work-related trauma was more widely recognised as a result of the pandemic, this had not prompted any significant investment in wellbeing programmes. Similarly, action on addressing drivers of stress and poor mental health like workforce shortages, task shifting and poor workplace cultures has also been insufficient. There are of course exceptions to this rule, with one EWTB member introducing standardised mental health screening within annual occupational health check-ups and mental health initiatives being set up by healthcare workers in a number of countries. However, poor mental health continues to be highly stigmatised in the majority of contexts and little is done to publicise the support that is available, leaving healthcare workers isolated and forcing many to leave the profession.

TB Preventive Treatment

TB Preventive Treatment (TPT) is a course of one or more anti-TB medicines that can clear TB infections before it progresses into TB disease. TPT is a key component of global strategies to end TB and critical in healthcare settings because it can dramatically reduce the number of people who develop TB disease and thus break chains of transmission.

When deciding whether to offer TPT to a person with TB infection, the potential benefits of treatment must be balanced with the risk of drug-related adverse events. Guidance has often noted that the benefits of TPT are less likely to outweigh harms in settings where the risk of reinfection is higher, including healthcare settings in high TB burden countries (WHO 2020).

However, the increased availability of shorter regimens, ongoing efforts to improve IPC in healthcare settings, and a desire to address inequalities in TB care across high- and low-income countries has resulted in a normative shift. As a result, the 2023 WHO Operational Handbook on TB Prevention recommends periodic screening and TPT for all healthcare workers (WHO 2023).

Case Study: Fullerton Health

Fullerton Health is a leading private healthcare platform, providing healthcare solutions to corporate and private clients across 9 countries across Asia. Fullerton staff are expected to adhere to strict IPC protocols and the company operates a comprehensive occupational health programme for all employees, including regular screening for signs and symptoms of TB and other occupationally acquired illnesses.

Fullerton provides onsite occupational health services for a range of corporate clients, including those operating in higher risk environments such as the extractive industries. Ensuring that workers who develop TB are quickly diagnosed and close contacts are appropriately managed is critical to avoiding larger outbreaks, as is keeping healthcare workers safe while undertaking screening, diagnosis and follow-up.

During the COVID-19 pandemic, a number of clients invested in strengthening airborne IPC across their facilities, including onsite clinics. At one LNG Plant in Celebes Province in Indonesia, a separate room with a negative pressure system was constructed to enable aerosol generating diagnostic procedures to be carried out more safely, alongside the installation of a laboratory with a biosafety cabinet.

This equipment has since been repurposed to support routine occupational health services. Since 2023, the team has already diagnosed 5 patients with active TB disease and 3 patients with TB infection following contact tracing. Patients with active TB are treated off-site while still infectious and then return to work, being monitored by the onsite clinic until treatment is successfully completed. The advanced on-site infrastructure enables more rapid diagnosis and follow-up, while keeping both patients and on-site healthcare staff safe in a higher-risk environment.





BUILDING A SHIELD AROUND HEALTHCARE WORKERS

Transmission of TB and other infectious agents can occur in a wide variety of ways, and the deployment of a single IPC or occupational health strategy is highly unlikely to protect healthcare workers sufficiently.

Having a stockroom full of FFP2 masks is of little use if there is no guidance on when and how to use them. A doctor wearing said mask while examining a patient remains at risk if the facility is poorly ventilated and the concentration of infectious droplets remains high when she leaves the room and removes her mask. Rates of nosocomial TB transmission will remain high despite robust IPC in TB wards if general waiting rooms, corridors and outpatient clinics have little to no airborne IPC. It is difficult to design and implement effective occupational health programmes if there is insufficient screening and monitoring of HAI-data.

This means that investing time and money into only one component of IPC or focusing exclusively on minimising transmission of a particular pathogen, is unlikely to deliver the necessary impact. Instead, governments, providers and individual healthcare facilities need to take a holistic approach, understanding the risks and barriers in their particular setting and strengthening the shield around healthcare workers as a whole.

While the exact mix of interventions will necessarily vary depending on what is viable in the local infrastructure and resource context, a core set of universal precautions should be in place across all healthcare facilities to significantly reduce the transmission of TB and other airborne pathogens. These include the following key, and overlapping, areas for action.

AREAS FOR ACTION: ACHIEVING SAFE AIR IN HEALTHCARE FACILITIES				
Administrative	Environmental	Transmission-Based	Occupational Health	
Symptom triage on arrival Separation of patients with respiratory symptoms Appointment systems to reduce waiting times Rapid testing and prompt initiation of treatment (based on DST results)	Implementation of natural and/or mechanical ventilation systems across all patient care areas Regular assessment of ventilation strategies, including through use of Co2 monitors Dedicated (respiratory) isolation facilities Use of Upper Room Ultraviolet Germicidal Irradiation where adequate ventilation is not feasible (e.g. cold climate)	Provision of surgical masks for patients with respiratory symptoms on arrival Consistent use of N95 or FFP2 masks by healthcare workers in contact with patients with respiratory symptoms	Annual screening of healthcare workers for signs and symptoms of TB Psychosocial support for HCW struggling with mental health (incl. in context of TB treatment completion) Training and leadership initiatives Anti-Stigma workplace policies and practices, including recruitment and continuing professional development.	

Case Study: Apollo Hospitals

One of the central pillars of effective infection prevention and control is reducing the overall burden of infectious diseases within a population – reducing the likelihood of healthcare workers and members of the general public being exposed to a pathogen in the first place. Aside from providing timely diagnosis and quality treatment, healthcare workers can play a critical role in this effort by increasing awareness of the signs and symptoms of TB and encouraging early care seeking behaviour.

Over the last three decades, Apollo Hospitals has been providing high-quality, affordable healthcare across its 71 private hospitals in India. Apollo is founded on a total health cycle philosophy, focusing not only on screening, diagnosing, and treating patients, but also educating and empowering to prevent further ill health.

As part of the Corporate TB Pledge Initiative, Apollo hospitals has committed to be a part of India's TB elimination efforts, leveraging the expertise of its healthcare workers to conduct awareness raising and engagement activities to achieve TB Free Workplaces. Over 60 talks, webinars and campaigns have been conducted in recent weeks, reaching staff of India's leading employers, including Axis Bank, IBM, Eureka Forbes and the Airport Authority of India.

ADDRESSING BARRIERS TO EFFECTIVE AIRBORNE IPC

It is clear that, despite individual examples of best practice, overall standards of airborne IPC in healthcare facilities are insufficient to deliver on the Sustainable Development Goal of ending TB by 2030, to meet employer obligations towards healthcare workers, and to prevent the transmission of novel and pandemic-prone airborne pathogens that are likely to emerge in the near future.

During the literature review and key informant interviews, a number of common barriers emerged which must be overcome to strengthen airborne IPC across public and private sector healthcare facilities. These include:

Prioritising IPC in global TB response

It is notable that while prevention is highlighted in all major global TB frameworks, including the End TB Strategy, the Stop TB Partnership's Global Plan to End TB 2023-2030, and the political declarations of the UN High-Level Meeting on TB, this has focused heavily on prevention through the development of a novel vaccine and the provision of TB preventive treatment.

As this paper has highlighted, however, nosocomial transmission is a substantial and preventable driver of the TB burden. Furthermore, robust IPC is a critical workplace obligation of all employers, be they in the public or private sector. Perhaps most significantly, IPC is also a crucial component of the quality of care provided to TB patients, with poor IPC increasing the risk of patients contracting TB, developing drug-resistant TB and other secondary infections.

Greater stakeholder collaboration, involving private and public health sector leaders, healthcare worker groups, civil society and affected communities, is therefore needed to advance this agenda within governance fora at the global, regional, and national level.

Recommendation 1: Mainstream (airborne) IPC as a quality-of-care and prevention issue within national, regional, and global governance and accountability forums, including multi-sectoral accountability frameworks, the World Health Assembly and the 2027 UN High-Level Meeting on TB.

Prioritising the broader airborne IPC agenda

Many key informants also noted that prior to the pandemic, global frameworks on IPC focused heavily on the prevention of contact transmission through strengthened water, sanitation and hygiene (WASH) practices. With an estimated 1.8 billion people using healthcare facilities that lacked basic water facilities, this is no doubt an important priority (WHO 2022). Nonetheless, while the transmission of airborne pathogens like TB and influenza often goes unnoticed, the pandemic demonstrated the considerable risk posed by airborne transmission and underlines the urgent need to ensure airborne IPC is sufficiently prioritised in broader IPC frameworks.

The experts we interviewed raised their concerns that attention is already beginning to wane post-pandemic, with airborne IPC being pushed back to the realm of TB programmes alone. This is particularly worrying as successful efforts at strengthening airborne IPC usually require multiple rounds of policy development, implementation, and evaluation (Kielman et al 2020), emphasising the importance of building a robust baseline of airborne IPC now to ensure there is sufficient capacity to expand mitigations in the event of a changing risk environment (e.g. outbreak of MDR-TB or novel pathogen).

The launch of the new WHO Action Plan on IPC at the 2024 World Health Assembly offers a unique opportunity to streamline airborne IPC within the global IPC agenda, and to ensure global efforts to bolster IPC address persistent inequities between higher and lower income countries. The TB community in particular can help lead efforts to build on the lessons of the COVID-19 and set the foundations for more integrated health systems strengthening.

Recommendation 2: Include airborne IPC as a priority pillar in national IPC Action Plans, PPPR and UHC frameworks, and ensure sufficient prioritisation of airborne IPC in global and regional IPC discussions.

Strengthening the policy environment

The greater prioritisation of TB IPC and airborne IPC agendas more broadly must translate into concrete policy reforms and investments by governments, through domestic budgets as well as the allocation of Overseas Development Assistance to address global IPC inequity. Priority steps include expanding national IPC programmes, setting aside ear-marked budgets for transformation efforts and strengthening collaboration across health services to set standards, drive compliance and shift culture. Occupational health services should also be strengthened to ensure earlier detection of illness and better psychosocial support for all healthcare workers. Key informants also highlighted the importance of health system leaders addressing structural barriers, including workforce shortages and workplace culture by investing in training and leadership development.

While the private providers interviewed as part of this publication went above and beyond any national regulations, there was a recognition that this was not universal across the diverse sector. Informants emphasised that greater engagement with private sector providers was needed to drive up standards, particularly in smaller, independent clinics. The role of accreditation schemes was highlighted in this regard, both voluntary and linked to legal registration, as was the need for establishing mechanisms to incentivise and support private providers engaging in IPC strengthening efforts. Working together with global, national and sub-national platforms for private sector providers is a sensible entry point for such initiatives, ensuring frameworks were implementable and enforceable on the ground.

Finally, the need for more integrated action across government ministries was also highlighted, as was the need to strengthen collaboration with different professional groups. This includes, for example, ensuring healthcare workers employed by the judicial systems are not missed in IPC initiatives. Similarly, informants noted the growing trend of reforming architectural regulations to ensure new healthcare facilities are built to meet robust ventilation and environmental standards. Similarly, working with ministries of education and professional bodies can ensure IPC is mainstream in medical training and accreditation across both public and private sectors, and identify new pathways for IPC-focused career progression.

Recommendation 3: Strengthen national and local IPC and occupational health programmes, including through the allocation of earmarked budgets and the appointment of empowered leaders, focusing on the areas for action highlighted above.

Recommendation 4: Strengthen national IPC policy frameworks, regulations, and systems, including through closer collaboration with relevant ministries, professional bodies, and the private sector.

Enabling innovative IPC programmes

Throughout interviews, key informants highlighted that the threshold for investment in IPC infrastructure, training and leadership was often significantly lower in the private sector than the public sector. This is in no small part due to the financial incentives of reputational management and minimising workforce costs. Key informants also noted the potential risk of litigation, with a series of high-profile class action lawsuits regarding airborne IPC targeting private sector employers in recent years.

In the public sector, where resources are often more constrained and demand is high, the threshold for investment in IPC was deemed artificially high, particularly in the context of relatively low costs and considerable reward. Informants noted that frameworks used to assess whether or not to implement a given intervention in state-funded healthcare systems are based on diagnostic and treatment tools and therefore have a heavy preference for randomised control trial data with human subjects and concrete cost efficiency data. However, this is very difficult to generate for IPC measures due to the high number of variables, the ethical imperative not to expose TB naive individuals to the pathogen and the necessarily interdisciplinary nature of IPC research.

While there is growing evidence of the impact and cost effectiveness of a range of IPC interventions in certain settings (Bozzani et al 2023; McCreesh et al 2021), a number of key informants noted that progress on airborne IPC has been hampered by these evidence thresholds. Giving facilities the freedom to develop and implement IPC programmes that respond to their specific risk environment relies on a greater appetite to test approaches in light of the immense risk posed by the current status quo.

Crucially, by supporting services to measure the effectiveness of these interventions in their particular context, including through operational research funding, additional real-world data may be generated to further support the development of innovative, evidence-based airborne IPC strategies.

Recommendation 5: Enable greater IPC innovation by supporting the implementation and real-world assessment of novel tools and strategies with a 'strong enough' evidence base.

Tackle TB stigma

The dangerous impacts of TB stigma have been highlighted by TB survivors all over the world, undermining care seeking behaviour, standing in the way of effective contact tracing efforts, consistent mask wearing, and reducing chances of treatment completion and undermining the long-term recovery of TB survivors.

Stigma is also frustratingly prevalent among healthcare workers themselves, in some cases undermining the quality of care offered to patients. More broadly, however, the stigma associated with TB also undermines IPC efforts by perpetuating false stereotypes about people with TB suffering from other, stigmatised vulnerabilities such as HIV and malnutrition. Such myths lead to reduced compliance with PPE and broader IPC measures and delayed care seeking behaviour. Both social stigma and formal occupational health policies may disincentivise healthcare workers from disclosing TB symptoms or diagnoses, undermining monitoring and learning, and sustaining false narratives about healthcare workers not being affected by TB.

During the UN High-Level Meeting on TB, all member states committed to intensifying national efforts to eliminate all forms of tuberculosis-related stigma (UNGA 2023). To date, there has been comparatively little investment in proactive stigma reduction campaigns on TB, particularly when compared to highly successful initiatives in the HIV space. As this paper shows, there is not only an urgent need to rectify this, but a real value in ensuring stigma reduction activities at both the general public and healthcare workers.

Recommendation 6: Invest in proactive stigma-reduction plans and campaigns, targeting both the general public and healthcare workers in particular.



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