# Biosafety and MODS

A misconception has arisen that there is an increased laboratory biohazard associated with the MODS methodology for TB and MDRTB diagnosis[1]. This is partly because MODS utilises liquid media and partly because the full procedure has not been clearly understood.

We firmly believe that MODS is actually considerably safer than indirect TB drug susceptibility methods.

This is why.

**The hazard of positive TB cultures in liquid media arises from spillage risk and manipulation of cultures teeming with organisms.**

- Conventional wisdom recognizes that liquid TB culture media (such as that used in MODS, MGIT, BACTEC and MBBacT systems) pose a greater biohazard than solid media because of the risk of spillage, aerosolisation and larger mycobacterial loads.

- Manipulation of positive liquid cultures is particularly hazardous[2]. Indeed, performance of standard indirect (secondary) drug susceptibility testing (DST), involving the use of bacterial isolates from TB culture, requires handling of mycobacterial suspensions thousands of times more concentrated than those found in pre-inoculation clinical specimens, thus dwarfing the risks associated with handling sputum samples.

**MODS utilises direct DST (inoculation of sputum samples instead of culture isolates) thus avoiding culture manipulation**

- As a methodology utilising **direct** DST, MODS actually results in considerably less biohazard exposure risk than methods requiring isolate manipulation.

**Spillage risk is nullified by sealing MODS plates in zip-lock bags**

- Because inoculated culture plates are sealed within polythene ziplock bags from which they are never removed (microscopic examination is done through the transparent bags), the culture amplification of *M tuberculosis* occurs within a closed system. The only consequence of a dropped plate is a spoiled culture as any spillage is completely contained.

**Biosafety requirements - P3 is neither necessary nor appropriate**

- Biosafety level 3 standards require a ventilation system with uni-directional airflow, external exhausting of laboratory air and careful continuous maintenance. The risks associated with ventilation system failure are well known. Increasing complexity demands increased maintenance expertise and costs which are prohibitive in the resource-limited settings where TB is most prevalent.

- Safe TB culture requires:
  1. a well-organised laboratory with a biological safety cabinet (BSC) and lockable door
  2. appropriate protective clothing and NIOSH approved respirators used at all times by laboratory workers

- The risks associated with TB laboratory work relate primarily to sample preparation, culture manipulation and waste disposal. Culture manipulation is by far the most hazardous of these as highly concentrated aliquots of mycobacteria are exposed to the laboratory air; thus a call for P3 facilities might be justified[2] when indirect DST is performed.

- However this does not apply to MODS for which a well-positioned and properly maintained class IIA BSC in a room with sealed windows and a reasonable door seal are sufficient. Such a system re-circulates exhausted HEPA filtered air into a closed room, thus cleaning room air and providing a safe environment at lower capital and maintenance cost. This is more than adequate for the MODS methodology in which the only potential period of risk is in sample preparation for plate inoculation.

- Elegant data from Korea demonstrating increased risk of TB infection amongst laboratory workers performing DST but not amongst those setting up cultures when compared to those only performing smear microscopy support this assertion[3] (figure reproduced from original article below).

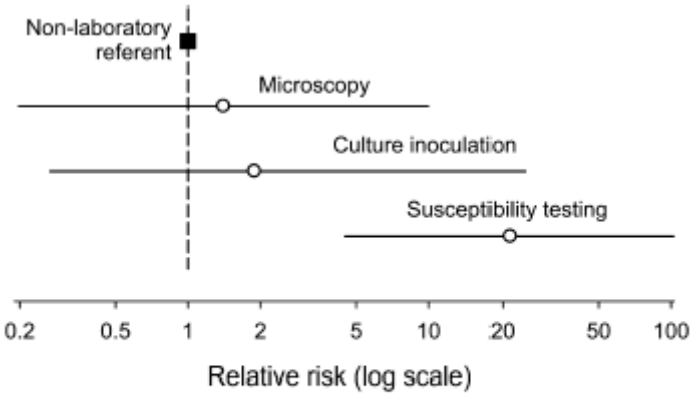


**Figure** Relative risk and 95% confidence intervals of tuberculosis among laboratory technicians compared to administrative staff, by type of laboratory work.

**References**

1. Moore DA, Evans CA, Gilman RH, et al. Microscopic-observation drug-susceptibility assay for the diagnosis of TB. The New England journal of medicine 2006;355(15):1539-50.
2. Iseman MD, Heifets LB. Rapid detection of tuberculosis and drug-resistant tuberculosis. The New England journal of medicine 2006;355(15):1606-8.
3. Kim SJ, Lee SH, Kim IS, Kim HJ, Kim SK, Rieder H. Risk of occupational tuberculosis in National Tuberculosis Programme laboratories in Korea. Int J Tuberc Lung Dis 2007; 11(2): 138-142

*See also:* *Moore DAJ, Gilman RH, Friedland JS. MODS assay for the diagnosis of TB. N Engl J Med 2007; 189*