Tuberculosis Ultraviolet Shelter Study (TUSS) (1997-2004), New York, NY

An outbreak of TB cases in major US urban centers in the late 1980s led to a reapplication of upper room ultraviolet germicidal irradiation (UVGI) fixtures in high risk congregate settings. St. Vincents Hospital New York provided primary healthcare services to unhoused persons in twelve locations in Manhattan. Philip Brickner, MD, Head of St. Vincents Community Medicine Department recalled the use of UV lamps in active TB wards when he was a resident at Bellevue Hospital in the 1950s.

His search for people knowledgeable on how to apply UV lights led to a review of the UV air disinfection science with medical clinicians and scientists which showed sound evidence for application; however, there was a desire to provide a real-world study of effectiveness. St. Vincents and Harvard School of Public Health crafted the Tuberculosis Ultraviolet Shelter Study (TUSS) of effectiveness during the TB outbreak.

TUSS placed 1200 UR fixtures in 14 homeless shelters –from church basements with no ventilation-to built-for-shelter, mechanically ventilated spaces, covering 200,000 sq ft. The UR UVGI systems were designed with engineering guidelines and monitored for output and safety over a course of seven years.

During the study, TB was controlled by directly observed therapy (taking the TB medicine) which didn't allow a definitive outcome of effectiveness; however, it did show that with proper engineering, monitoring and maintenance these systems could be deployed with occupant safety. Later studies in Lima, Peru and Pretoria, South Africa showed airborne TB transmission from active TB patients to guinea pigs equipped with UR UVGI could reduce risk of transmission by 80%. These studies led to a World Health Organization (WHO) recommendation of use of UR UVGI for high-risk settings (WHO 2019 TB IPC update).

Combining this information with application guidance from TUSS, ASHRAE is developing Guidelines on application of UR Germicidal UV systems (Chaired by Equity Air member Richard Vincent, Mt Sinai School of Medicine).

Costs for this New York installation in 2004 was approximately $4.60 per square foot. Operation costs include electricity and lamp replacement. The annual cost of electricity per fixture is $28, assuming a power demand of 31.4 watts per fixture, an operating schedule of 24 hours per day, and an electricity cost of $0.10 per kilowatt-hour. The lamps are replaced annually at a material cost of $43 per lamp.

Figure 2 TUSS New York City Shelter Showing UR UVGI fixtures on the wall in a 24 h/7days drop-in center where many persons stayed. (Source: TUSS)