Airborne Transmission of MRSA

Scientific studies which show evidence of MRSA airborne transmission.

1. "Significance of Airborne Transmission of Methicillin-Resistant Staphylococcus aureus in an Otolaryngology–Head and Neck Surgery Unit" by Teruo Shiomori, MD, PhD; Hiroshi Miyamoto, MD, PhD; Kazumi Makishima, MD, PhD *Arch Otolaryngol Head Neck Surg.* 2001;127:644-648

In this 2001 study, Japanese doctors attempted to measure if MRSA could be found in the air of a surgical hospital ward. The rooms of 3 patients who acquired MRSA after surgery were monitored with air samplers and surface swabbing.
Results: MRSA was detected in all 3 rooms in the air and on surfaces. 20% of the MRSA particles were within the respirable range, of less than 4 µm.
From this research: "Methicillin-resistant *S aureus* was recirculated among the patients, the air, and the inanimate environments, especially when there was movement in the rooms. Airborne MRSA may play a role in MRSA colonization in the nasal cavity or in respiratory tract MRSA infections. Measures should be taken to prevent the spread of airborne MRSA to control nosocomial MRSA infection in hospitals."

2. "Reduction in MRSA environmental contamination with a portable HEPA-filtration unit" by TC Boswell & PC Fox *Journal of Hospital Infection* 2006 May;63(1):47-54

In 2006 UK microbiology researchers wanted to know if filtering the air in a hospital would lead to a decrease in MRSA found on horizontal surfaces. Ward rooms housing "…heavy MRSA dispensers…" were supplied with portable HEPA filtration units.
Results: 95% of settle plates placed in the wards showed MRSA contamination. Plates were placed in a variety of locations, mostly along the perimeter of the room. When HEPA filtration was introduced, measurable MRSA decreased between 73%-95%. This study makes a direct link between air and the dispersion of viable MRSA.

From this study: "Although filtering the air in a hospital can not replace standard infection control measures (e.g. isolation, hand hygiene, protective clothing and cleaning), it is likely to reduce cross-infection risks significantly and could provide a relatively cost effective method for enhancing MRSA control."

3. "The relationship between airborne colonization and nosocomial infections in the intensive care unit", G Dürmaz, et al Mikrobiyol *Bul*. October 2005 (article in Turkish)

In 2005 Turkish researchers used more than 900 data points to measure airborne pathogens and the colonization of those pathogens in hospital patients. The study tracked 179 patients and found that MRSA is definitely airborne.
Results: Researchers proved that MRSA was airborne through the use of air samplers. The two most common airborne pathogens were MRSA and Acinetobacter baumannii. Furthermore, the study says there is a link between the concentration of these airborne pathogens and colonization in patients.
From this research: "It can be concluded that, total number of airborne viable particles in the critical areas such as operating theatres and intensive care units, seems to be a significant risk factor for the development of nosocomial infections in immuno-compromised patients."

4. "An outbreak of Serratia marcescens infection in a special-care baby unit of a community hospital in United Arab Emirates: the importance of the air conditioner duct as a nosocomial reservoir" S. A. Uduman, et al *Journal of Hospital Infection* (2002) 52: 175-180

A deadly outbreak of *S. marcescens* vexed the staff members of a NICU located in the United Arab Emirates (UAE). In total 36 infants were infected, leading to the death of five babies. Concerned healthcare workers desperately worked to find the source of the outbreak.

Results: Researchers determined that the reservoir of the deadly pathogen was the air conditioning system that fed the NICU. Despite many typical infection control interventions such as staff education, environmental cultures, isolation of colonized patients, compliance with aggressive infection control measures and recognition of the role of cross contamination the colonization of infants grew. When environmental sampling suggested that contamination was emanating from the air conditioning system, the hospital thoroughly sanitized the system. After this measure the 20 week outbreak ended.

From the study: "the growth of serratia from airflow samples suggested that the primary source of this outbreak was the air conditioner duct." "In conclusion, we have documented in this report the results of extensive surveillance and the importance of the air conditioner duct site as a reservoir of nosocomial pathogens in the SCBU of a community hospital. The possibility of airborne transmission in nosocomial spread should not be underestimated." Although there is ample evidence that MRSA and other pathogens are transmitted via the air, most infection control measures focus on contact precautions.

5. "Significance of Airborne Transmission of Methicillin-Resistant Staphylococcus aureus in an Otolaryngology–Head and Neck Surgery Unit" by Teruo Shiomori, MD, PhD; Hiroshi Miyamoto, MD, PhD; Kazumi Makishima, MD, PhD. Arch *Otolaryngol Head Neck Surg.* 2001; 127:644-648

This study is from the Medical School in Kitakyushu, Japan. The study took place in a hospital area that housed 37 patients recovering from head and neck surgery. Three patients in single occupancy rooms became infected with MRSA after surgery. Were all 3 patients colonized by the same strain of MRSA? If so, what was the source and how could patients in 3 separate rooms become infected with the same pathogen? Researchers used air sampling machines and surface swabs to collect MRSA samples. Then the samples were analyzed using polymerase chain reaction and pulsed-field gel electrophoresis. The result? "An epidemiological study demonstrated that clinical isolates of MRSA in our ward were of one origin and that the isolates from the air and from inanimate environments were identical to the MRSA strains that caused infection or colonization in the inpatients." The conclusions of this study indicate that disinfecting the air circulated within their ward could help reduce colonization of patients. "In this study, it was confirmed that MRSA could be acquired by medical staff and patients through airborne transmission. The findings suggest the importance of protecting patients against cross-infectious agents existing in aerosols. Although measures for prevention and control of nosocomial infection with MRSA include handwashing with an antimicrobial agent; wearing a gown, gloves, and a mask; and removing MRSA from the nasal vestibule, few measures have been established to control airborne bacteria. Laminar unidirectional airflow, air ventilation, and air filtration could also be beneficial in hospital environments and should be considered. Further studies will be needed to assess the levels of MRSA contamination of air and to develop more effective means of controlling and removing airborne MRSA."

6. "The Airborne Transmission of Infection in Hospital Buildings: Fact or Fiction" by C.B. Beggs, *Indoor and Built Environment*, Vol. 12, No. 1-2, 9-18 (2003)

This research was performed by the Aerobiological Research Group, School of Civil Engineering, University of Leeds.

Airborne transmission is known to be the route of infection for diseases such as tuberculosis and aspergillosis. It has also been implicated in nosocomial outbreaks of MRSA, *Acinetobacter* spp. and *Pseudomonas* spp. Despite this there is much scepticism about the role that airborne transmission plays in nosocomial outbreaks. This paper investigates the airborne spread of infection in hospital buildings, and evaluates the extent to which it is a problem. It is concluded that although contact-spread is the principle route of transmission for most infections, the contribution of airborne micro-organisms to the spread of infection is likely to be greater than is currently recognised. This is partly because many airborne micro-organisms remain viable while being non-culturable, with the result that they are not detected, and also because some infections arising from contact transmission involve the airborne transportation of micro-organisms onto inanimate surfaces.

***7. "*Role of ventilation in airborne transmission of infectious agents in the built environment – a multidisciplinary systematic review" by Y. Li [1] , G. M. Leung [2] , J. W. Tang [3] , X. Yang [4] , C. Y. H. Chao [5] , J. Z. Lin [6] , J. W. Lu [7] , P. V. Nielsen [8] , J. Niu [9] , H. Qian [1] , A. C. Sleigh [10] , H.-J. J. Su [11] , J. Sundell [12] , T. W. Wong [13] , P. L. Yuen [14] Indoor Air, Vol 17, Issue 1, 2-18 (2007)**

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Abstract There have been few recent studies demonstrating a definitive association between the transmission of airborne infections and the ventilation of buildings. The severe acute respiratory syndrome (SARS) epidemic in 2003 and current concerns about the risk of an avian influenza (H5N1) pandemic, have made a review of this area timely. We searched the major literature databases between 1960 and 2005, and then screened titles and abstracts, and finally selected 40 original studies based on a set of criteria. We established a review panel comprising medical and engineering experts in the fields of microbiology, medicine, epidemiology, indoor air quality, building ventilation, etc. Most panel members had experience with research into the 2003 SARS epidemic. The panel systematically assessed 40 original studies through both individual assessment and a 2-day face-to-face consensus meeting. Ten of 40 studies reviewed were considered to be conclusive with regard to the association between building ventilation and the transmission of airborne infection. There is strong and sufficient evidence to demonstrate the association between ventilation, air movements in buildings and the transmission/spread of infectious diseases such as measles, tuberculosis, chickenpox, influenza, smallpox and SARS. There is insufficient data to specify and quantify the minimum ventilation requirements in hospitals, schools, offices, homes and isolation rooms in relation to spread of infectious diseases via the airborne route.

Practical Implication: The strong and sufficient evidence of the association between air ventilation, the control of airflow direction in buildings, and the transmission and spread of infectious diseases supports the use of negatively pressurized isolation rooms for patients with these diseases in hospitals; in addition to the use of other engineering control methods. However, the lack of sufficient data on the specification and quantification of the minimum air ventilation requirements in hospitals, schools and offices in relation to the spread of airborne infectious diseases, suggest the existence of a knowledge gap. Our study reveals a strong need for a multidisciplinary study in investigating disease outbreaks, and the impact of indoor air environments on the spread of airborne infectious diseases.

8. "Air--Treatment Systems for Controlling Hospital-Acquired Infections" by W. Kowalski, PE, PhD. Heating, Piping, and Air Conditioning Engineering, April 2008

Levels of airborne microbes are not routinely checked in hospitals; however, a variety of studies have indicated that the air in hospital areas rarely, if ever, is sterile. Methicillin-resistant Staphylococcus aureus (MRSA) is a major nosocomial pathogen in many hospitals and is being isolated with increased frequency. According to one study reported by G. Duramax et al, MRSA is the most frequently isolated airborne microbe. The major sources of S. aureus (MRSA) in hospitals are septic lesions and carriage sites of patients and personnel. Anterior nares are the most common carriage site, followed by the perineal area. Although the principal mode of transmission is transiently contaminated hands of hospital personnel, airborne MRSA plays a role in respiratory-tract MRSA infections. MRSA has been found in air samples collected in single-patient rooms and has been isolated from sinks, floors, and bed sheets, as well as from patients' hands. MRSA recirculation in air is enhanced by activity in rooms, including the changing of bed sheets. The change that perhaps would have the greatest impact on nosocomial infections in this country is the establishment of national standards concerning aerobiological quality in hospitals. Routine air sampling, such as that recommended by the National Institute of Health Sciences in Japan, would provide a clearer picture of the relationship between airborne microbes and infection rates.

The Association for Professionals in Infections Control (APIC)

http://www.airborneinfection.blogspot.com/2007/06/apics-mrsa-study-good-start.html