# AIRBORNE BACTERIA IN THE OPERATING ROOM

A policy brief with recommendations to create a safer surgical environment






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# Introduction

This policy brief contains recommendations that are given to reduce the level of airborne bacteria in operating rooms in Ghana. Airborne bacteria represent a risk to patient safety, and increase the risk of post-operative wound infections. Postoperative wound infections are associated with high financial and human costs and should be prevented when possible. The policy brief is based on a scientific study conducted at Korle-Bu Teaching hospital, as part of the HAI-GHANA research collaboration between University of Ghana, Korle-Bu Teaching Hospital, University of Copenhagen, and Copenhagen University Hospital, Rigshospitalet.

# Background

Postoperative wound infection is a major complication of surgery associated with increased morbidity and high cost. Patients in low-resource settings are at particular risk of such infections, but there is limited knowledge about their causes from these settings. This knowledge gap prevents effective interventions to reduce the infection risk. Airborne bacteria in the operating room pose a risk of postoperative wound infections through microbial entry into an open surgical wound. We therefore conducted a scientific study with active air sampling during 124 surgical procedures at the General Surgery Unit of Korle-Bu Teaching hospital. As predictors of air contamination, we had particular focus on staff behaviour during the surgery. Door opening rate and the reasons for each door opening was therefore, along with several other factors, recorded by direct observation using pretested structured observation forms. Detailed statistical analysis was hereafter applied to examine possible relationship. To our knowledge no other scientific studies on staff behaviour and air quality in operating rooms have yet been conducted in a low- or middle-income country.

# Results

Of 510 air samples taken during surgery 84 % had bacterial counts above recommended levels and 36 % had bacterial counts high above recommended levels. There was a high number of people present during surgery (up to 23 people) and a high level of traffic in and out or the operating room. A strong correlation was found, with increased bacterial counts for each person present and each door opening during surgery. A high number of people present were merely observers and 77% of door openings could be classified as unnecessary.

# Conclusions

The study suggests a large potential for creating a safer surgical environment with low levels of airborne bacteria by reducing the number of people present and traffic flow in and out of the operating room.

# Implications

The high levels of airborne bacteria are a risk to patient safety, since high levels of airborne bacteria increase the risk of subsequent wound infection. Wound infections are associated with high financial and human costs and should therefore be prevented when possible. Efforts should thus be made to reduce the bacterial count. A change in operating room culture should be enforced by responsible parties aiming to minimize the number of people present inside the operating room, and only allowing people to enter or leave the operating room when it is crucial to the ongoing procedure or patient safety. Based on our study and the available literature we therefore recommend:

# Recommendations

**A BETTER OPERATING ROOM CULTURE:**

Limiting the traffic flow and number of people present in the operating room is key to secure clean air and a safe surgical environment. We therefore recommend:

- That all unnecessary door openings and people present during surgery are completely avoided.
- That all necessary equipment is brought to the operating room prior to the start of surgery
- Installation of piecing cabinets, allowing access to supplies and equipment from both inside and outside of the operating room, without the need to enter or leave.
- Use of telephone communication for urgent messages and questions that cannot be postponed until after surgery.

**EDUCATION AND STUDENTS**

A large number of the people present during surgery where students observing surgery as part of their education. Direct observation is a vital part of many health care related educations, and presence of students can thus not be completely avoided, but measures should be taken to reduce the number of observers during the individual procedure. We therefore recommend:

- Extended use of live video transmissions from the operating room, allowing students to observe surgery from other locations.
- Extended use of simulation based education, allowing students to train basic routine and teamwork in close-to-reality operating rooms, without patient contact.
- That students in the operating room are made an active part of the surgical procedure. When possible, students should replace ordinary staff members thus keeping the total number of people present low.

**VENTILATION**

A sufficient ventilation system is crucial to maintaining a supply of fresh and clean air, and remove bacteria spread by patients and staff members present. We therefore recommend:

- That operating rooms are equipped with a sufficient ventilation system capable of 15-20 air changes pr. hour and High Efficiency Particulate Air (HEPA) graded filtration capacity.
- That existing ventilation systems are subject to regular maintenance and change of filters.
- That the quality of ventilation systems is controlled with active air sampling before new operating rooms are taken into use, and when changes to the ventilation system is made.

With the above recommendations we believe that low levels of airborne bacteria can be achieved. We plan to study the effect of the recommendations in a subsequent part of the HAI-Ghana project. It should be noticed that the recommendations cannot alone constitute a full guideline for prevention of surgical site infections and that such a guideline should also include elements as; sterilisation of equipment, general cleaning of the operating room, aseptic surgical techniques, optimization of patient related risk factors and use of prophylactic antibiotics. Several guidelines exist covering these subjects.

# Further readings

**For details regarding the present study conducted at Korle-Bu Teaching Hospital please see:**

Stauning, Marius Tving, Antoinette Bediako-Bowan, Leif Percival Andersen, Japheth A. Opintan, Appiah-Korang Labi, Jørgen Kurtzhals, and Stephanie Bjerrum. "Traffic Flow and Microbial Air Contamination in Operating Rooms at a Major Teaching Hospital in Ghana." *Journal of Hospital Infection* (Online December 2017). doi:10.1016/j.jhin.2017.12.010.
Open access available at: http://dx.doi.org/10.1016/j.jhin.2017.12.010

**For details regarding ventilation in operating rooms we recommend:**

Hoffman, P.N., J. Williams, A. Stacey, A.M. Bennett, G.L. Ridgway, C. Dobson, I. Fraser, and H. Humphreys. "Microbiological Commissioning and Monitoring of Operating Theatre Suites." *Journal of Hospital Infection* 52, no. 1 (September 2002): 1–28. doi:10.1053/jhin.2002.1237.

**For details regarding other measures to prevent surgical site infections we recommend:**

Allegranzi, Benedetta, Peter Bischoff, Zeynep Kubila, Bassim Zayed, Stijn De-Jonge, Mohamed Abbas, Nizam Damani, and Joost Hopman. "Global Guidelines for the Prevention of Surgical Site Infections." 1st ed. Geneva: WHO Document Production Services, 2016. ISBN: 9789241541549882

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