

- (2008) 849-854. DOI: [10.1016/j.enbuild.2007.06.003](https://doi.org/10.1016/j.enbuild.2007.06.003).
3. Pfost, J.F., "A re-evaluation of laminar air flow in hospital operating rooms," *ASHRAE Transactions*, 87 (1981) 729-739.
 4. Villafruela, J.M., Castro, F., San José, J.F., Saint-Martin, J., "Comparison of air change efficiency, contaminant removal effectiveness and infection risk as IAQ indices in isolation rooms," *Energy and Buildings*, 57 (2013) 210-219. DOI: [10.1016/j.enbuild.2012.10.053](https://doi.org/10.1016/j.enbuild.2012.10.053).
 5. Dong, S.Y., Tu, G.B., Cao, R.G., Yu, Z.F., "Numerical study on effects of door-opening on airflow patterns and dynamic cross-contamination in an ISO Class 5 operating room," *Transactions of Tianjin University*, 15 (2009) 210-215. DOI: [10.1007/s12209-009-0037-y](https://doi.org/10.1007/s12209-009-0037-y).
 6. Brohus, H., Balling, K.D., Jeppesen, D., "Influence of movements on contaminant transport in an operating room," *Indoor Air*, 16 (2006) 356-372. DOI: [10.1111/j.1600-0668.2006.00454.x](https://doi.org/10.1111/j.1600-0668.2006.00454.x).
 7. Balocco C., Petrone G., Cammarata G., "Numerical investigation of different airflow schemes in a real Operating Theatre," *Int. Journal Biomedical Science and Engineering (JBiSE)*, 8: (2015) 73-89. DOI: [10.4236/jbise.2015.82008](https://doi.org/10.4236/jbise.2015.82008).
 8. Loomans, M.G.L.C., van Houdt, W., Lemaire, A.D., Hensen, J.L.M., "Performance assessment of an operating theatre design using CFD simulation and tracer gas measurements," *Indoor and Built Environment*, 17 (2008) 299-312. DOI: [10.1177/1420326X08094948](https://doi.org/10.1177/1420326X08094948).
 9. Yam, R., Yuen, P.L., Yung, R., Choy, T., *Rethinking Hospital General Ward Ventilation Design Using* (2011).
 10. Balocco, C., Petrone, G., Cammarata, G., Vitali, P., Albertini, R., Pasquarella, C.I., "Experimental and numerical investigation on airflow and climate in a real operating theatre under effective use conditions," *International Journal of Ventilation*, Vol 13 (4): (2015) 351-368.
 11. Chen, Y.G., "Parametric evaluation of refrigerated air curtains for thermal insulation," *International Journal of Thermal Sciences*, 48 (2009) 1988-1996. DOI: [10.1016/j.ijthermalsci.2009.03.003](https://doi.org/10.1016/j.ijthermalsci.2009.03.003).
 12. Zhai, Z.Q., Osborne A., "Simulation-based feasibility study of improved air conditioning systems for hospital operating room," *Frontiers of Architectural Research*, 2 (2013) 468-475. DOI: [10.1016/j.foar.2013.09.003](https://doi.org/10.1016/j.foar.2013.09.003).
 13. ANSI/ASHRAE - 170 (2008), Ventilation of Health Care Facilities. ASHRAE Standards Committee, the ASHRAE Board of Directors, and the American National Standards Institute, USA.
 14. UNI-11425 (2011), Surgery Operating Theatre, Ventilation and Air-Conditioning System for Contamination Control (VCCC) Design, Construction, Commissioning, Qualification, Management and Maintenance. Italy. (In Italian)
 15. ISPESL (2009), Department of Occupational Hygiene, Guidelines for the Definition of Safety Standards and Environmental Health Departments Operators. (In Italian)
 16. COMSOL (2012), *Multiphysics User's Guide*, v.4.3. Comsol Inc.
 17. Ignat, L., Pelletier, D., Ilinca, F.A., "Universal formulation of two-equation models for adaptive computation of turbulent flows," *Computer Methods in Applied Mechanics and Engineering*, 189 (2000) 1119-1139. DOI: [10.1016/S0045-7825\(99\)00370-9](https://doi.org/10.1016/S0045-7825(99)00370-9).
 18. Launder, B.E., Spalding, D.B., "The numerical computation of turbulent flows," *Computer Methods in Applied Mechanics and Engineering*, 3 (1974) 269-289.
 19. Deuffhard, P.A., "Modified newton method for the solution of ill-conditioned systems of nonlinear equations with application to multiple shooting," *Numerische Mathematik*, 22 (1974) 289-315. DOI: [10.1016/0045-7825\(74\)90029-2](https://doi.org/10.1016/0045-7825(74)90029-2).
 20. ANSI ASHRAE Standard - 55 (2013), Thermal Environmental Conditions for Human Occupancy, ASHRAE Standards Committee, the ASHRAE Board of Directors, and the American National Standards Institute, USA.
 21. Ho, S.H., Rosario, L., Rahman, M.M., "Three-dimensional analysis for hospital operating room thermal comfort and contaminant removal," *Applied Thermal Engineering*, 29 (2009) 2080-2092. DOI: [10.1016/j.applthermaleng.2008.10.016](https://doi.org/10.1016/j.applthermaleng.2008.10.016).
 22. Liu, J.J., Wang, H.D., Wen, W.Y., "Numerical simulation on a horizontal airflow for airborne particles control in hospital operating room," *Building and Environment*, 44 (2009) 2284-2289. DOI: [10.1016/j.buildenv.2009.03.019](https://doi.org/10.1016/j.buildenv.2009.03.019).
 23. Chow, T.T., Yang, X.Y., "Ventilation performance in operating theatres against airborne infection: review of research activities and practical guidance," *Journal of Hospital Infection*, 56 (2004) 85-92. DOI: [10.1016/j.jhin.2003.09.020](https://doi.org/10.1016/j.jhin.2003.09.020).
 24. Zoon, W.A.C., Loomans, M.G.L.C., J.L.M., "Testing the effectiveness of operating room ventilation with regard to removal of airborne bacteria," *Building and Environment*, 46 (2011) 2570-2577. DOI: [10.1016/j.buildenv.2011.06.015](https://doi.org/10.1016/j.buildenv.2011.06.015).
 25. Karthikeyan, C.P., Samuel, A.A., "CO₂-dispersion studies in an operation theatre under transient conditions," *Energy and Buildings*, 40 (2008) 231-239. DOI: [10.1016/j.enbuild.2007.02.023](https://doi.org/10.1016/j.enbuild.2007.02.023).
 26. Chow, T.T., Yang, X.Y., "Ventilation performance in operating theatres against airborne infection: numerical study on an ultra-clean system," *Journal of Hospital Infection*, 59 (2005) 138-147. DOI: [10.1016/j.jhin.2004.09.006](https://doi.org/10.1016/j.jhin.2004.09.006).

NOMENCLATURE

Symbol

C_p	[J/(kg K)]	Specific heat at constant pressure
CO_2	[ppm]	Carbon dioxide concentration
CFU	[-]	Colony Forming Unit
H	[J/kg]	Enthalpy
K	[W/(m K)]	Thermal conductivity
P	[Pa]	Pressure
U	[m/s]	Velocity magnitude
T	[s]	Time
T	[K]	Temperature

Greek symbols

η	[Pa s]	Dynamic viscosity
ρ	[kg/m ³]	Density
τ	[s]	Mean age of air