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Abstract: Understanding the risk of airborne transmission can provide important information for designing safe healthcare environments with an appropriate level of environmental control for mitigating risks. The most common approach for assessing risk is to use the Wells–Riley equation to relate infectious cases to human and environmental parameters. While it is a simple model that can yield valuable information, the model used as in its original presentation has a number of limitations. This paper reviews recent developments addressing some of the limitations including coupling with epidemic models to evaluate the wider impact of control measures on disease progression, linking with zonal ventilation or computational fluid dynamics simulations to deal with imperfect mixing in real environments and recent work on dose–response modelling to simulate the interaction between pathogens and the host. A stochastic version of theWells–Riley model is presented that allows consideration of the effects of small populations relevant in healthcare settings and it is demonstrated how this can be linked to a simple zonal ventilation model to simulate the influence of proximity to an infector. The results show how neglecting the stochastic effects present in a real situation could underestimate the risk by 15 per cent or more and that the number and rate of new infections between connected spaces is strongly dependent on the airflow. Results also indicate the potential danger of using fully mixed models for future risk assessments, with quanta values derived from such cases less than half the actual source value.

Keywords: airborne infection; ventilation; Wells–Riley; stochastic; hospital; compartment