

Clostridium difficile
Aerobiology and nosocomial transmission

by

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ABSTRACT

Clostridium difficile infection (CDI) is a plight for patients and a burden for the health economy.

Needed antibiotic treatment is also a contributing risk for developing CDI, and the spores are resistant to alcohol gel.

It is endemic in many English hospitals as well as in the community, where it produces clusters and outbreaks of CDI.

Recently, as part of a hospital "clean air programme" air sterilisation units were introduced. It had previously proved efficient against MRSA in controlling the spread and protecting patients.

The acute trauma ward suffered a severe outbreak of diarrhoea and vomiting hence it was decided to equip it with ten Ultraviolet air sterilisation units (Medixair®).

The first quarter reduced the number of CDI cases from 12 to 4, and the subsequent three quarters had either none or just one case of CDI.

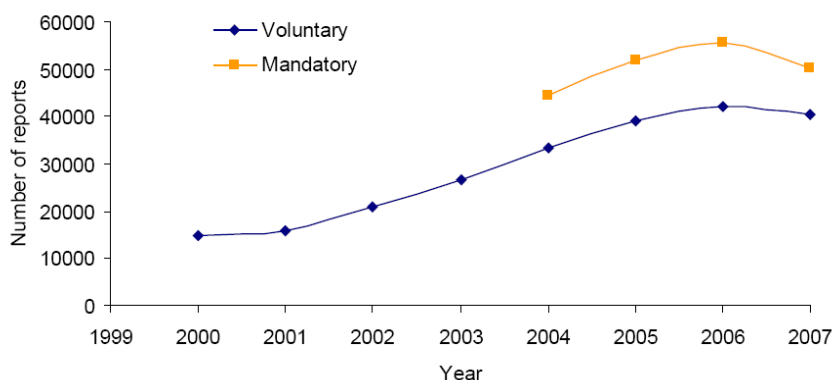
The hospital as a whole demonstrated a modest reduction of the total number of CDI cases, but not to the same degree as in the acute orthopaedic trauma ward.

In conclusion, ultraviolet air sterilisation seems to reduce the number of CDI outbreaks and the number of cases.

It is hypothesised that the airborne mode of transmission plays a role in transmission of *Clostridium difficile*, just as it has been demonstrated for MRSA.

INTRODUCTION

In England, *Clostridium difficile* infections (CDI) have for years been raising. The key interventions have been hand washing, barrier nursing, cleaning together with antibiotic prescription control; however, with modest success.



Trend in *C.difficile* reports for patients aged 65 years and over reported via the mandatory and voluntary reporting systems, 2000 to 2007 [Surveillance on HCAI report 2008].

In the late spring of 2007 the acute orthopaedic trauma ward experienced a major outbreak of diarrhoea and vomiting due to *Clostridium difficile* and *Norovirus*. A maximum of nine new cases of CDI were recorded in just one month.

As an interventional measure it was decided to place some newly acquired ultraviolet air sterilisation units in the department. We had just completed a study demonstrating its efficiency in controlling MRSA.¹

The purpose of this presentation is to report on our experience and achievement in using air sterilisation units.

METHODS



The study took place in London in a large acute general hospital. The acute orthopaedic trauma ward consists of five 4-5 bed bays and five single bed side-rooms. Data from the mandatory national *Clostridium difficile* surveillance scheme were analysed over the period January 2006 to June 2008.

From July 2007 ten Ultraviolet air sterilisation units were placed in the trauma ward. One in each side-room and one in each bay.

The ultraviolet air sterilisation unit (Medixair®, Pathogen Solutions, UK) is a mobile encapsulated unit that draws in 25 m³ air per hour. Airborne microorganisms are in this way exposed to the bactericidal effect of ultraviolet light at wave length 256.7 nm.

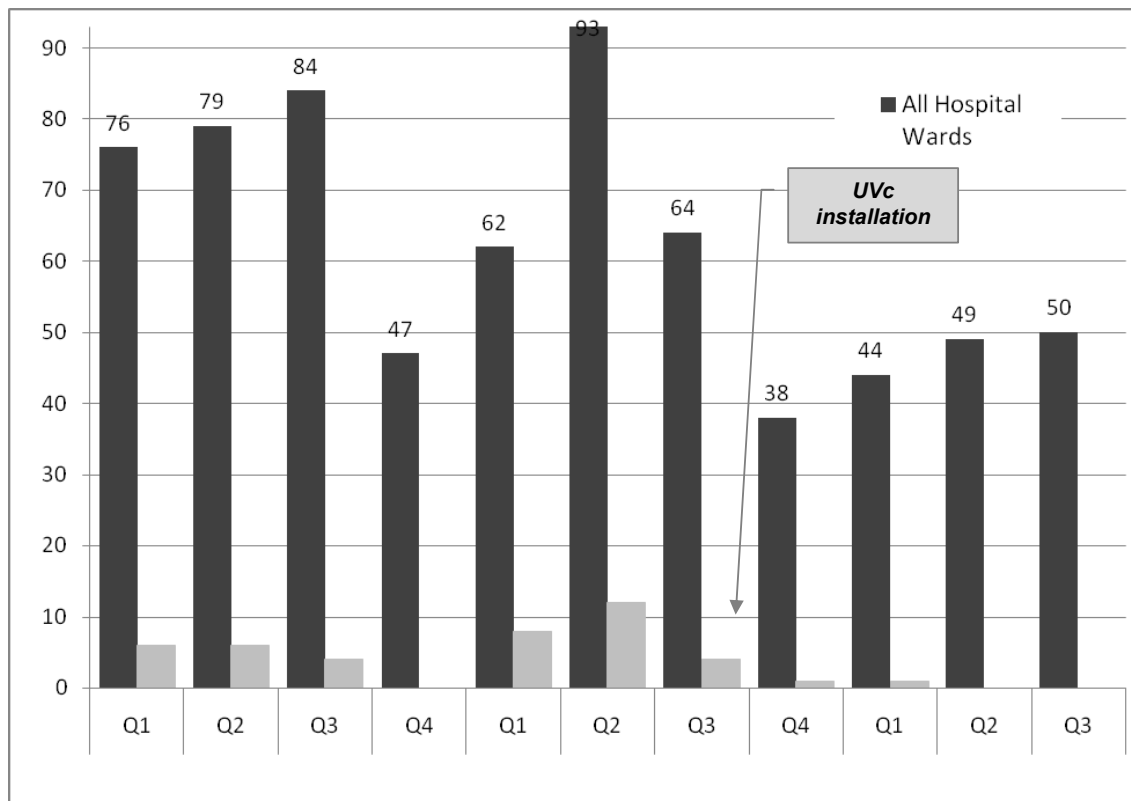
During the study period the hospital had an active programme against CDI. The programme for the trauma ward was not distinct from the rest of the hospital apart from the installation of the air sterilisation units.

RESULTS

The table shows the actual number of new cases of CDI for the hospital as well as the trauma ward.

	2006				2007				2008		
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3
Acute Trauma Ward	6	6	4	0	8	12	4	1	1	0	0
All Hospital Wards	76	79	84	47	62	93	64	38	44	49	50

It is seen that the hospital reduced the average number of CDI cases per six months from 146 (Jan 06 to Jun 07) to 98 (Jul 07 to Sep 08), a reduction of 33%. On the same basis the trauma ward achieved a 80% reduction from 12 cases per six months to 2.4 cases. The outbreak seems to continue into the first quarter, however, the last four quarters had either none or only one new case of CDI.



DISCUSSION AND CONCLUSION

Clostridium spores survive long in the environment. However, it may also become airborne and transported by the wind over a kilometre of distance. This is the lessons from biological warfare and laboratory accidents. It would be reasonable to conclude that *Clostridium difficile* spores have the same ability and therefore also have an airborne mode of transmission.

The general professional understanding is that direct and indirect contact are responsible for colonisation of patients and contamination of the environment. A recent extensive (2008) review for Department of Health, UK, has not even mentioned airborne transmission.²

A literature search on PubMed produced only one publication related to airborne transmission.³

The present study compares two time periods. One where the air is actively sterilised and one without. The air sterilisation unit has only one function *viz.* to sterilise air. It does not protect against direct contact transmission or contaminated hands. Its function is solely directed against bacteria and spores that become airborne and subsequently pass through the air sterilisation unit.

The study results support the hypothesis that airborne transmission may play a role in cross-infections and colonisation of patients, and also contamination of environment with *Clostridium difficile*.

REFERENCES

¹Nielsen PB, Rangaiah JS. Ultraviolet Sterilised Bed Room Air Protects Patients Against MRSA (Abstract P46). 8th Congress of the International Federation of Infection Control. Budapest, Hungary, 2007.

²*Clostridium difficile* Infection: How to Deal with the Problem. A Board to Ward Approach. A report to the Department of Health from the Steering Group on Healthcare Associated Infection. February 2008.

³Roberts K, Smith CF, Snelling AM, et al.: Aerial dissemination of *Clostridium difficile* spores. BMC Infectious Diseases 2008; 8: 7