

Emerging infections – implications for dental care

N. P. Monaghan¹

In brief

Highlights the risk of transmission of emerging infections in dental settings.

If dental teams are aware of these issues they can reduce the risks to them and their patients.

Dentistry is often forgotten when new infections emerge; the appointment of dental emerging infection leads could ensure prompt advice is available.

Over the last 20 years the majority of emerging infections which have spread rapidly across the globe have been respiratory infections that are spread via droplets, a trend which is likely to continue. Aerosol spray generation in the dental surgery has the potential to spread such infections to staff or other patients. Although the diseases may differ, some common approaches can reduce the risk of transmission. Dental professionals should be aware of areas affected by emerging infections, the incubation period and the recent travel history of patients. Elective dental care for those returning from areas affected by emerging infections should be delayed until the incubation period for the infection is over.

Emerging infections

An infectious disease is regarded as emerging when the number of humans contracting an infection has increased in the past 20 years, or when there is threat of such increase in the near future.¹

There are different reasons why a disease may emerge including:

- New infections from changes or evolution of existing organisms
- Infections affecting new areas (for example, possibly associated with ecological changes such as global warming)
- Old infections re-emerging because of poor public health measures or the development of antimicrobial resistance.

Infectious diseases that are transferred easily from person to person have scope for rapid spread. Airline travel in particular can contribute to rapid spread across the globe. In 2002 a new infection emerged, severe acute respiratory syndrome (SARS), initially in China but rapidly spread via international travellers to other Asian

countries, Toronto, Spain and the UK.² SARS was caused by the SARS CoV virus, a coronavirus related to some of the viruses associated with common colds. There were 747 deaths among 9,098 reported cases. Half of those over 65 who were known to have been infected died.

Currently there is ongoing surveillance about a different coronavirus – MERS CoV, which originated in the Middle East. This new infection is now suspected to have originated from a single animal source, a camel, in 2011 or earlier.^{3,4} MERS CoV was first reported in 2012 and by July 2015 had been reported in 21 countries. While most cases have involved people from or visiting Saudi Arabia, there is an ongoing outbreak in the Republic of Korea.⁵

Between 2003 and 2008 it was predicted that a new form of influenza might emerge to affect humans.⁶ Birds in South East Asia were expected to be the source. There are many strains of influenza viruses and many host species. Birds, dogs, horses, pigs, humans and many other species of mammals can be affected by influenza A viruses.⁷ In 2009 when a new influenza pandemic did occur it started through contact with pigs in Mexico. The virus was H1N1, similar to the strain involved in the 1918 'Spanish' influenza pandemic which killed about 50 million people and to the 1977/78 'Russian' flu virus.⁸

Ebola has been known about since 1976.⁹ The outbreak in West Africa which commenced in December 2013 has led to cases being managed

in the USA, Italy, the UK and Spain. As of 20 January 2016 there have been 28,602 known cases associated with 11,301 deaths.¹⁰ By August 2014 there had been 1,000 deaths in West Africa and a British volunteer nurse had contracted the disease and been flown back to the UK for emergency treatment.¹¹ Within the UK guidance was issued to dental teams in England (December 2014), Wales (December 2014), Northern Ireland (January 2015) and Scotland (February 2015).¹²⁻¹⁵

The emerging infection which hit the news in January 2016 is Zika virus. This virus is carried by mosquito species such as *Aedes aegypti*, which also carries yellow fever and dengue viruses. Zika virus was first discovered in Uganda in 1947 and since has slowly spread through South Asia and Pacific islands to reach Brazil.¹⁶ Currently there are concerns about possible links with microcephaly. A known rare complication of Zika infection is Guillain Barré syndrome. Currently, Zika infection risk in the UK would be limited to imported cases of people infected abroad, reflecting the locations where mosquitoes are carrying Zika virus. *Aedes aegypti* is currently restricted to presence in Madeira, Georgia and South Russia, although it was recently found for the first time in the Netherlands.¹⁷ In none of these areas has Zika virus been reported to date.¹⁸

The emerging infections noted above are those which have hit the UK media. There are many other emerging infections. TB is

¹Consultant in Dental Public Health, Public Health Wales, Temple of Peace and Health, Cathay's Park, Cardiff, CF10 3NW
Correspondence to: Nigel Paul Monaghan
Email: nigel.monaghan@wales.nhs.uk

Accepted 10 May 2016

DOI: 10.1038/sj.bdj.2016.486

©British Dental Journal 2016; 221: 13-15

re-emerging in some areas, particularly London where it accounts for 40% of all UK cases.¹⁹

Relevance to dentistry

Given features of the infections which have emerged (or been expected to emerge) over the last 20 years and have potential to spread rapidly and cause significant loss of life, what is the relevance to dentistry? Among the diseases which have emerged two are coronaviruses, one an influenza virus.

Coronaviruses and influenza viruses are spread via droplets, aerosols, or through direct contact with respiratory secretions of someone with the infection. The virus particles can survive within small droplets in the air for several hours.²⁰ Thus when influenza is circulating there is a potential higher risk of transmission within dental practices because of the aerosol sprays generated by drills and ultrasonic scalers. For influenza it is thought that this risk of transmission is restricted to the room where dental care is given, provided the door to the room is closed.^{21,22} In the early phase of response to H1N1, when there were concerns that this form of influenza caused high mortality, the American guidance recommended negative pressure air handling and full fit-tested protective equipment.²³

In recent years a large proportion of the emerging infections have been viral infections of the respiratory tract, spread through droplets and aerosols. These have the potential to pass from person to person, and even country to country, very quickly. Dental practice, involving both close contact to the airway and generation of aerosol sprays, presents a high-risk environment to catch or pass on these infections.²⁴ However this risk can be reduced by use of masks and gloves, pre-procedure rinses, rubber dam and high volume suction.²⁴

While not a 'digestive tract infection', Ebola is an infection which can be transmitted from body fluids including those affecting the digestive tract. The virus can survive for several days outside the body and a person can become infected via the mouth.²⁵ It is common for people to be advised not to kiss those who are symptomatic with gastrointestinal infection. Although Ebola virus is not believed to commonly spread as a result of droplet generation, contact with mucous membranes of an affected person is a mechanism for transmission of the virus. Aerosol sprays bombardment of mucous membranes of someone with the disease is a

potential mechanism to facilitate transmission of Ebola (or a digestive system infection) when the causative organism may be present in the mouth of those infected. Viruses are present in saliva of those very sick with Ebola. Droplet transmission of Ebola from aerosol spray has not been demonstrated to date, although there is a report of a healthcare worker inadvertently rubbing her eyes with soiled gloves who then developed Ebola disease.²⁶ Based on the limited evidence it would seem best to avoid aerosol spray generation from the mouth of someone with the disease.

By contrast Zika is spread by mosquito bites. Provided that normal precautions against blood-borne viruses are used there would seem to be no reason to suppose that dental care is a risk for transmission of the Zika virus.

Implications for the dental team

With appropriate knowledge it is possible to reduce the risk of transmission of emerging infections in dental settings. The key principles in managing someone who may have been in contact with an emerging infection are: establishing whether contact with someone affected is possible, delaying non-urgent care until incubation periods are over, and use of appropriate precautions to provide care which cannot be delayed.

The implications for the dental team include:

- Being aware of emerging infections
- Being aware of incubation periods
- Being aware of patients' recent travel history
- Delaying elective treatment of those from (or returning from) affected areas who may have been in contact with cases until the incubation period has passed to reduce risk of transmission
- For urgent treatment of those who may have the disease or may have been in recent contact with cases, seeking advice from health protection colleagues before providing care and use of full protective equipment.

While new diseases do not emerge to become a problem every year, when they do emerge and are reported on the news it would be sensible for members of the dental team to find out a little more about the infection. Key information includes whether a new infection affects the respiratory or digestive tracts, awareness of affected geographical areas, awareness of incubation periods and any advice issued by health protection experts and

government health departments.

Avoiding provision of elective dental treatment to those who may have been exposed to the disease is a key response. For many emerging infections there will be an incubation period. Elective treatment can be delayed until after the incubation period has ended. Similarly if a person survives an infection, is free of symptoms and shown to be free of the causative organism, elective care can be provided.

Not all dental care is routine and sometimes interventional treatment is needed urgently. If urgent dental care is required for symptomatic returnees or for those who have had contact with symptomatic individuals, advice should be sought from a health protection team before treatment commences. Personal protective equipment and modification of cross infection precautions will be needed appropriate to the mode of transmission of the organism.²⁷ Decontamination of the surgery and equipment will also be needed. The surgery is more likely to become widely contaminated through aerosol sprays, therefore aerosol spray generation should be minimised. Experience with SARS highlights appropriate responses for a highly infectious high mortality respiratory infection.^{28,29} In the absence of negative pressure operating rooms there are products which can help to manage the air in an aerosol generating environment.³⁰

Past experience suggests that the dental team can be forgotten when new infections emerge. If we are alert and are clear about the information we need, we can ask for up to date answers and modify our practice accordingly. Public health organisations should consider appointing someone with responsibility for emerging infections and dentistry with strong links to both health protection colleagues responsible for emerging infection responses and dental professionals. Their role would ensure that dental care is not forgotten when new infections emerge and that early appropriate advice is available to dental professionals.

Conclusion

Predicting the future is an uncertain business. We cannot predict accurately when the next emerging infection will arise and what it will be, but we can identify features of such diseases with implications for dentistry.

Recent experience suggests that most emerging infections with potential to spread rapidly across the globe and cause significant loss of life will affect the respiratory tract.

Dental professionals should be aware of (and be made aware of) such infections because they have potential to be spread by generation of aerosol sprays in the oral cavity.

Awareness of emerging infections and of patient travel histories can assist us in reducing the risk of transmission of emerging infections in dental settings. If we strengthen links with health protection colleagues responsible for emerging infection responses we will be well placed to keep dental professionals informed.

1. Centers for Disease Control and Prevention. Emerging Infectious Diseases. 2010. Available at: <http://wwwnc.cdc.gov/eid/page/background-goals> (accessed January 2016).
2. NHS Choices. SARS (severe acute respiratory syndrome). 2014. Available at: <http://www.nhs.uk/conditions/sars/Pages/Introduction.aspx> (accessed January 2016).
3. Lau S K, Lee P, Tsang A K, Yip C C, Tse H, Lee R A. Molecular epidemiology of human coronavirus OC43 reveals evolution of different genotypes over time and recent emergence of a novel genotype due to natural recombination. *J Virol* 2011; **85**: 11325–11337.
4. Cotten M, Lam T T, Watson S J *et al.* Full-genome deep sequencing and phylogenetic analysis of novel human betacoronavirus. *Emerg Infect Dis* 2013; **19**: 736–742B.
5. World Health Organization. Middle East respiratory syndrome coronavirus (MERS-CoV) 2015. Available at: <http://www.who.int/mediacentre/factsheets/mers-cov/en/> (accessed January 2016).
6. Directorate-General for Health and Consumer Protection European Commission. Factsheet – Avian influenza. 2006. Available at: http://ec.europa.eu/health/ph_threats/com/docs/factsheet_influenza_en.pdf (accessed January 2016).
7. Webster R, Bean W, Gorman O, Chambers T, Kawaoka Y. Evolution and ecology of influenza A viruses. *Microbiol Rev* 1992; **56**: 152–279.
8. Taubenberger J, Morens D. 1918 influenza: the mother of all pandemics. *Emerg Infect Dis* 2006; **12**: 15–22.
9. World Health Organization. Ebola haemorrhagic fever in Sudan, 1976. Report of a WHO/International Study Team. *Bull World Health Organ* 1978; **56**: 247–270.
10. World Health Organization. Ebola Situation Report 20 January 2016. Available at: <http://apps.who.int/ebola/current-situation/ebola-situation-report-20-january-2016> (accessed January 2016).
11. BBC News. British Ebola patient arrives in UK for hospital treatment. 24 August 2014. Available at: <http://www.bbc.co.uk/news/uk-28919831> (accessed January 2016).
12. Public Health England. Ebola Guidance for Dental Care Teams. 2014. Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/404012/Ebola_guidance_for_dental_care_teams.pdf (accessed January 2016).
13. Public Health Wales. Ebola Dental Guidance Wales. 2014. Available at: <http://www.wales.nhs.uk/sitesplus/888/document/256013> (accessed January 2016).
14. Health Protection Scotland. Ebola Guidance for Dental Care Teams. 2015. Available at: <http://www.scottishdental.org/ebola-guidance-for-dental-care-teams/> (accessed June 2016).
15. Department of Health, Social Services and Public Safety. Northern Ireland Ebola Guidance for Dental Care Teams. 2015. Available at: <https://www.dhsspsni.gov.uk/publications/ebola-guidance-dental-care-teams> (accessed January 2016).
16. Gatherer D, Kohl A. Zika virus: a previously slow pandemic spreads rapidly through the Americas. *J Gen Virol* 2016; **97**: 269–273.
17. European Centre for Disease Prevention and Control. Aedes aegypti. 2015. Available at: <http://ecdc.europa.eu/en/healthtopics/vectors/mosquitoes/Pages/aedes-aegypti.aspx> (accessed January 2016).
18. European Centre for Disease Prevention and Control. Epidemiological update: Outbreaks of Zika virus and complications potentially linked to the Zika virus infection. 2015. Available at: http://ecdc.europa.eu/en/press/news/_layouts/forms/News_DispForm.aspx?ID=1437&List=8db7286c-fe2d-476c-9133-18ff-4cb1b568&Source=http%3A%2F%2Fecdc%2Eeuropa%2Eeu%2Fen%2Fpress%2Fepidemiological%5Fupdates%2FPages%2Fepidemiological%5Fupdates%2Easpx (accessed June 2016).
19. Zumla A. The white plague returns to London with a vengeance. *Lancet* 2011; **377**: 10–11.
20. Yang W, Elankumaran S, Marr L C. Concentrations and size distributions of airborne influenza A viruses measured indoors at a health centre, a day-care centre and on aeroplanes. *J R Soc Interface* 2011; **8**: 1176–1184.
21. Centers for Disease Control and Prevention. Prevention of 2009 H1N1 Influenza Transmission in Dental Health Care Settings. 23 November 2009. Available at: http://www.cdc.gov/oralhealth/infectioncontrol/factsheets/2009_h1n1.htm (accessed May 2016).
22. Department of Health. Pandemic (H1N1) 2009 influenza A summary of guidance for infection control in health-care settings. 2009. Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/357401/infection_control_in_healthcare_settings.pdf (accessed May 2016).
23. Centers for Disease Control and Prevention. Prevention of Swine Influenza A (H1N1) in the Dental Healthcare Setting. Available at: <http://www.cdc.gov/oralHealth/InfectionControl/pdf/swineflu.doc> (accessed May 2016).
24. Harrel S K, Molinari J. Aerosols and splatter in dentistry: a brief review of the literature and infection control implications. *J Am Dent Assoc* 2004; **134**: 429–437.
25. NHS Choices. Ebola virus disease - How it spreads. 2014. Available at: <http://www.nhs.uk/Conditions/ebola-virus/Pages/how-it-spreads.aspx> (accessed January 2016).
26. Centers for Disease Control and Prevention. Review of Human-to-Human Transmission of Ebola Virus. 2015. Available at: <http://www.cdc.gov/vhf/ebola/transmission/human-transmission.html> (accessed January 2016).
27. Harte J A. Standard and transmission-based precautions – an update for dentistry. *J Am Dent Assoc* 2010; **141**: 572–581.
28. Li R W K, Leung K W C, Sun F C S, Samaranyake L P. Severe Acute Respiratory Syndrome (SARS) and the GDP. Part I: Epidemiology, virology, pathology and general health issues. *Br Dent J* 2004; **197**: 77–80.
29. Li R W K, Leung K W C, Sun F C S, Samaranyake L P. Severe Acute Respiratory Syndrome (SARS) and the GDP. Part II: Implications for GDPs. *Br Dent J* 2004; **197**: 130–134.
30. Hallier C, Williams D W, Potts A J C, Lewis M A O. A pilot study of bioaerosol reduction using an air cleaning system during dental procedures. *Br Dent J* 2010; **209**: E14.