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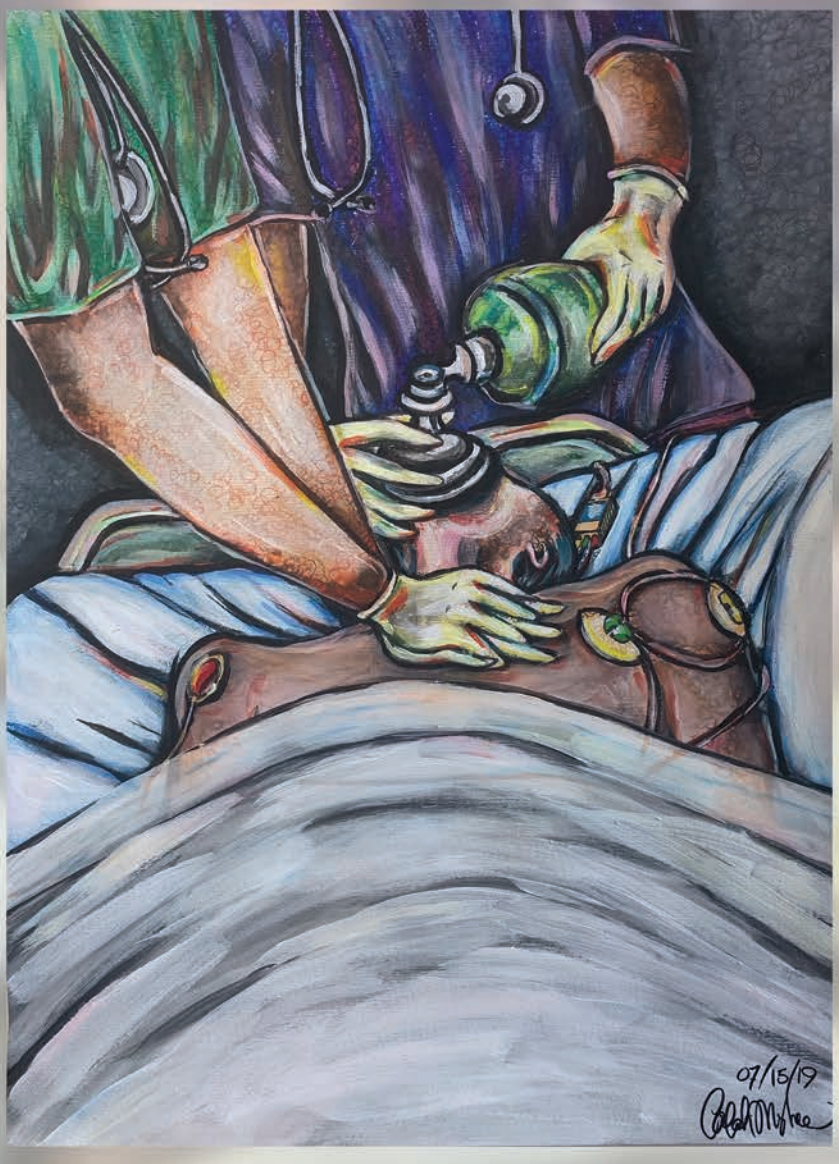

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Outbreaks—What's in a name?

By Nevio Cimolai

You are covering the afternoon shift in a community hospital emergency department. Five females have presented to the emergency department sporadically with clinical pyelonephritis over the same timeframe. Over the next few days, you overhear two casualty officers (emergency physicians) expressing the findings that all five patients suffered from Escherichia coli urinary infections.

Did you experience an outbreak?

Answer: possibly, but quite likely not.

Common urinary infections among females are usually sporadic infections in which the causative bacterium, most often *E. coli*, is acquired from the patient's own microbial flora. For some unlucky patients, the bacterium may ascend from the bladder to cause a kidney infection. The probability that a series of such infections so seen in the Emergency Department (ED) constitute an outbreak is extremely small. Had the females all been maintaining urinary catheters and residing in the same chronic care facility, or had the females all attended the same urological endoscopy suite in the previous few days, one might have thought otherwise regarding the possibility of an outbreak.

What is an infection outbreak?

Outbreaks, as reported in the media, are rather glorified events and a large part of the impression made often relies on the large numbers of affected individuals. The severity of the infections may also attract attention. It is the public impact factor that strikes at the centre of how an outbreak may be perceived.

On a more scientific basis, a definition of "outbreak" is simple and pragmatic (Cimolai & Cimolai, 2012). Effectively, an outbreak may be declared when the number of infections over a given time period exceeds the number anticipated by historic knowledge. That is, past experience provides a normative baseline to which the current number of infections can be compared. It may be very clear in some circumstances that the numbers are well above those anticipated as the norm. At other times, the elevation in event frequency needed to assert an outbreak can be somewhat arbitrary. Small numbers of infections may especially be relevant in an outbreak setting when the baseline is typically none at all. For example, the occurrence of three nosocomial influenza infections on a single care ward would be considered an outbreak given that none would be seen at most times. Understanding what the norm should be could, at times, prove tricky, since even a low-grade endemic number of a specific infection may represent an ongoing outbreak. For example, food-borne infections with *Salmonella* might be identified sporadically in the community and measured over many months and, yet, the vector food and *Salmonella* strain may have been the same all along, thus indicating a smoldering form of outbreak. The timing during which the infections are identified can, thus, be a very brief or very extended timeframe.

When outbreaks occur on a large scale, the common epithet is the term 'epidemic'. The latter will generally apply to regional outbreaks. When outbreaks or epidemics are considerably broad in geographical terms, for example involving multiple continents, the term 'pandemic' is likely to be applied, although again the numbers of infection usually factors into calling the event a pandemic.

Confusing to some, are the potential over-riding concepts of microbial isolates and strains. An 'isolate' is just that—a given germ that was isolated in the laboratory. Each time a microbe is defined from the laboratory sample as having been present, one has obtained an isolate. Isolates of microbes in the laboratory may or may not have a common source. 'Strain' implies that there is some commonality among given isolates. That is, if several isolations of methicillin-resistant *Staphylococcus aureus* (MRSA) from clinical samples are genetically linked, they constitute samples of a common strain. In this era, there are very sophisticated methods to type isolates to determine if they are, indeed, common strains (Struelens, 2001). For example, in assessing new influenza isolates annually, variation in the laboratory isolates can be determined down to the level of their RNA code. Fingerprints of microbes can be defined nearly overnight with current laboratory methods. 'Clone' defines microbe isolates that have come from a common origin. Over time, the clone of microbes may remain genetically similar or there may be some slow genetic divergences that create variations on the behaviour of the germs or variations in how the fingerprints may change. In the outbreak setting, it is typical for the isolates in the laboratory to have a common strain profile—that is, they show clonality. Much less common is the potential for several strains to cause infections in the same outbreak. For example, in one scenario, the author and colleagues determined that a common environmental contamination in an intensive care unit was causing problems with multiple co-existing strains of *Serratia marcescens* (Cimolai, Trombley, Wensley, & Leblanc, 1997).

Different strains of a common germ may possess varying ability to create infection or varying ability to influence the severity of infection. For any given patient and infection, the severity will depend on both human and microbial factors. The medical and public impacts of infectious outbreaks are, thus, quite heterogeneous. An infectious disease may be modified by fluctuation in host susceptibility over time, and one can witness different degrees of infection intensity as the microbes mutate over time and modify their virulence factors.

The Emergency Department as a sentinel

Infections constitute a large proportion of perceived medical emergencies that present to the ED. Patients are becoming more likely to attend EDs for infectious problems as their access to medical invigilation becomes more compromised with the perceived slow access in primary community care. There is also the trend

in society that timeliness and perfection in medical care should be attainable and are basic human rights given the resources that medical services now command in government budgets. The infections that present to the ED, thus, often have an urgency factor and/or a severity factor. The latter make it more likely that infections seen in this setting could be part of an outbreak. This is why some provincial viral watch programs for seasonal influenza may use ED data as part of their surveillance processes.

Outbreak infections can be diagnosed in the ED solely on clinical grounds, for example, clinical influenza, or institutional post-operative infections. Results of laboratory samples from the ED may also provide evidence of commonality in the reports of microbial isolations. The latter, although perhaps at times evident to the ED personnel, is best screened for through a solid institutional infection control program. ED triage or other points of entry constitute an excellent focus for some of the infection control data collection.

The Emergency Department as source or vector

Apart from attending to patients whose infections may be part of an outbreak, could the ED activities serve as the source of the infection if not the mechanism by which infections may be passed to incoming patients or, for that matter, medical staff? There are very few, if any, environments in medical institutional settings where infections cannot originate or be transmitted. If anything, the ED is likely to be one of the more likely.

The emergency setting draws patients with perceived significant infections. The ED is not uncommonly crowded and, hence, reduces the physical distance between patients who are arriving infected, especially of concern for airborne respiratory infections. Patients may often wait for extended periods of time, which increases the chances of microbial contact. The paraphernalia in most current emergency rooms is considerable. The diversity of such inanimate objects has increased more than not. Keyboarding enhances the hand contact role for infection spread. Procedures in this setting also increase the potential for contact. Having multiple service providers over a short period of time increases physical transmissibility. Greater attention to non-infectious aspects of patient visits may detract from the infection control precautions otherwise more easily afforded when staff have the opportunity to be more focused on infection. Sanz et al. once published on the evidence that procedural objects, such as ultrasound probes could pose risk for transmission (Sanz, Theoret, Liao, Erickson, & Kendall, 2011). Risk of transmitting germs via the proverbial stethoscope route in the ED have often attracted attention (Núñez, Moreno, Green, & Villar, 2000; Jones, Hoerle, & Riekse, 1995).

As for all other medical venues, the ED will never be a sterile environment. Accordingly, the risks for the ED to act as vector or source can be more or less.

The emergency department as a helpful participant

To an outsider, the ED nurse is a gregarious type. He or she has a high competence profile, seeks an intense medical scenario, welcomes knowledge bases and acquisition, and is a great person to work with (Eldred, 1977). While obvious to many, some have sought to prove the latter with a measure of science (Kennedy, Curtis & Waters, 2014). The ED nurse is no less empathetic and compassionate than any other (Atkins & Piazza, 1987). What better person to have some role in the understanding of outbreaks and in the general realm of infection control?

Given the busy enterprise of emergency care, one wouldn't expect ED nurses to give extraordinary time to recognizing outbreaks, but any little insight in this regard is welcome from an institutional infection control service. Enforcing common infection control principles and overseeing them is nevertheless an important role. Who else in the ED will seriously take on that role? Ensuring appropriate triage related to the presenting infection, invoking methods of prevention and quarantine, post-visit disinfection, and advising on infection control generally may be in the purview of nursing care and/or commentary. It is up to the individual or the collective nursing management to ad hoc, or on a grander scale, determine how much emphasis can be afforded. While we seek perfection to prevent infection, we do not demand everlasting perfection, but rather seek reasonableness.

Attitudes and management

The example of MRSA will be well within most experienced ED nurse's domain. The last decade or more experienced a large resurgence and then decline in superficial and soft tissue infections with this category of bacterium (Cimolai, 2010). What was largely circulating then were some hypervirulent clones that caused, initially, considerable infection in the community and then, eventually, in acute care settings. The roles of the inanimate medical environment and the patient in maintaining the bacterium for spread was evident (Cimolai, 2008a). Also, unfortunately, for some medical personnel, they unknowingly participated in the spread of MRSA (Cimolai, 2008b). Why then would the problem reach such a proportion that legislators in some domains felt obligated to invoke solid mandates for the control (Cimolai, 2007a)?

Patients and medical personnel are humans. Their loyalty to preventing infections is affected by many different variables. Even during outbreak situations, some are simply fed up with the effort that must be directed toward prevention. It may pose a nuisance during an otherwise pre-occupied existence. How many patients and personnel avoid handwashing if not only for the distraction that it may seem? ED nurses are well-positioned to act as intervenors. They can improve the status quo with practical teaching and purposeful example. ED nurses are in a position to simplify infection prevention while maintaining effectiveness. When there is a counter-culture to appropriate behaviour, they can lead the way back to an expected norm with their positivistic attitudes (Cimolai, 2007b).

Key points

1. The ED can be the focus for infection spread and for outbreak recognition. An outbreak can be proposed when the number of infections over a given time period exceeds the anticipated number.
2. The ED has the onus to integrate with effective institutional infection control programs.

3. The ED nurse is a competent and enterprising individual who can facilitate the surveillance and application of effective infection control.
4. The ED nurse is a pragmatic individual who can assist in steering appropriate attitudes and management to prevent infections.

Today, you, Nurse Chloe, are working in the ED triage of a very busy hospital. Two parents and three children are attending with complaints of what they perceive to be severe respiratory infections. They are recent immigrants to Canada, but have returned from a short visit to a country in the Middle East this last week. The mother volunteers a concern that some relatives told them of local infections overseas that resembled SARS.

What do you do?

The Great Canadian Outbreaks was published with the intent of providing a more public view of outbreaks (Cimolai, 2018). Ten short stories were created to illustrate historic Canadian episodes in broad scope and with a pan-national perspective. In particular, topics such as enterohemorrhagic E. coli and 'hamburger disease', smallpox, tuberculosis, MRSA, SARS, listeriosis, pandemic influenza, blood-borne transfusion infections, Q fever, and pseudo-outbreaks are themes for prose that is of mixed fact and fiction. Some may be very familiar with some of the names, topics, and places of this medical history.

About the author

Nevio Cimolai, MD, FRCP(C), is a practising physician and academic university professor. His career has included general practice, specialty practice, basic science and clinical research in several fields, medical administration and public health service, medical publication and editorial support, and curriculum development and reform. He has taught both undergraduate and postgraduate students in medical fields as diverse as nursing, medical technology, primary medical school, and postmedical graduate education. His former postgraduate teaching program was awarded the highest commendation from the Royal College of Physicians and Surgeons of Canada, and he has personally been awarded for undergraduate teaching excellence. He has provided lectureships and organized symposia on local, national, and international levels. He maintains specialty interest in medical microbiology and clinical infection and has published books and book chapters on basic science microbiology, medical microbiology, infectious diseases, public health, and infection control. He has provided more than 400 oral and written publications in the scientific and clinical fields.

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