Editorial

Hospital-acquired Infections — A Clean Bill of Health?

This year marks the 150th anniversary of the untimely death of Ignaz Semmelweis. His name might be unfamiliar to many of you, but he was a pioneer of antiseptic policy whose recommendations revolutionized healthcare by limiting the spread of hospital-acquired infections (HAIs).

While working as a physician in Viennese obstetric clinics, Semmelweis observed that the incidence of puerperal fever (caused by a bacterial infection of the female reproductive tract) could be drastically reduced when doctors washed their hands in chlorinated lime. Helped by Pasteur's germ theory, which offered a scientific explanation to Semmelweis' observational evidence, the practice of handwashing in hospitals eventually earned widespread acceptance.

Despite this preventative measure, HAIs currently affect approximately 10% of patients throughout the USA and Europe, causing respiratory, gastrointestinal, urinary tract, surgical site and blood-borne infections, complicating recovery and contributing to patient mortality. Prolonged hospital stays and additional therapeutic interventions, often using antibiotics, add to the financial burden on already strained healthcare systems.

Complicating matters further, the drugs that have been routinely used to treat many of these infections are losing their potency as bacteria develop antibiotic resistance. The emergence of ‘superbugs’ that are either intrinsically resistant, or acquire resistance by the transfer of genetic material, is driven by the selection pressure imposed by antibiotic use, allowing resistant bacteria to flourish at the expense of their sensitive counterparts. Compounding this situation is the fact that bacteria evolve mechanisms to bypass previously effective antibiotics, there is a paucity of new antibiotics in development. This disparity threatens to revert healthcare to a pre-antibiotic era, leading to a dire situation with significant public health ramifications. Recently, the World Health Organization published “Worldwide country situation analysis: Response to antimicrobial resistance”, highlighting the current situation and outlining how best to address the issue on a global scale. On May 25, 2015, delegates at the World Health Assembly endorsed this global action plan, urging member states to make it a national priority and mobilize additional resources for its implementation. Progress will be reported to the Health Assembly in 2017.

Many factors have contributed to the escalation of antibiotic resistance. From a medical practitioner’s standpoint, inappropriate prescription of antibiotics and complacent use of wide-spectrum antibiotics have exerted selection pressure on a similarly broad group of microbes. The general public plays a part when demanding antibiotics from their doctors for self-limiting viral infections, failing to complete a full course of antibiotics, or by propagating the black-market sales of antibiotics — an immediate problem in developing countries. Crucially, farmers use antibiotics as prophylaxis against infection and as a means to promote the growth of their animals (although the latter practice is banned in the EU), which expedites widespread resistance. Governments have, until recently, seemed ill-informed of the impending danger, or chose to focus their efforts elsewhere, so effective policy was not formulated. Finally, for their part, pharmaceutical companies re-directed efforts towards more profitable therapeutic areas at the cost of antibiotic development. In sum, antibiotic resistance was an inevitability — an impending crisis that nobody wanted to acknowledge.

There is still hope, but it relies on a concerted effort from all of the parties mentioned above. Scientists must invest in the development of new antibiotics and governments should support this enterprise and provide robust public health policy. One such initiative, launched on June 10, 2015, is Antibiotic Discovery Global. This network of experts from the industry and academia aim to use their knowledge base and infrastructure to support global antibiotic development and discovery. Another strategy to stimulate change is to incentivize the process. On June 2, 2015, The U.S. Department of Health and Human Services proposed a competition in which up to $20 million would be made available for the delivery of diagnostics that identify bacterial infections, thereby promoting antibiotic stewardship. Proposals are currently being considered.

A recent innovation resulting from an academic-pharma partnership was the identification of a new class of antibiotic. Spearheaded by Kim Lewis at Northeastern University, Boston, MA, USA, and reported in Nature on January 22, 2015, teixobactin was discovered by screening bacteria in soil. Teixobactin was able to kill problematic Gram-positive bacteria by inhibiting cell wall synthesis, without producing newly resistant strains — a resistance-resistant antibiotic had been found. These results have been received with tentative optimism. Not only is this the first novel class of antibiotic to be described in decades, but it is also hoped that the screening methodology can be used to identify many more, including those against Gram-negative bacteria that are resistant to virtually all modern antibiotics.

Semmelweis’ life ended tragically. After becoming increasingly frustrated by the resistance of the medical community to adopt hand disinfection into clinical practice, he wrote a series of offensive open letters to prominent obstetricians accusing them of being irresponsible murderers. His behavior became erratic, he was ostracized professionally and became detached from his family. In the summer of 1865, Semmelweis was invited to visit a Viennese insane asylum, where he was beaten and incarcerated against his will. Two weeks later, aged 47, Semmelweis died from a gangrenous wound.

The act of eschewing new knowledge because it contradicts entrenched norms is often called a ‘Semmelweis reflex’. Hopefully the current antibiotic crisis is no longer being met with a Semmelweis reflex and the gap between antibiotic resistance and antibiotic development will begin to close. However, this situation will require effective collaboration and a desire to embrace innovation — something Semmelweis would have benefited from 150 years ago.