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Methicillin-resistant *Staphylococcus aureus*, *Clostridium difficile*, and extended-spectrum β -lactamase-producing *Escherichia coli* in the community: Assessing the problem and controlling the spread

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Although health care-associated methicillin resistant staphylococcus aureus and clostridium difficile strains are primarily a risk to hospital patients, people are increasingly concerned about their potential to circulate in the community and the home. They are thus looking for support in order to understand the extent of the risk, and guidance on how to deal with situations where preventing infection from these species becomes their responsibility. A further concern are the community-acquired MRSA and *C. difficile* strains, and other antibiotic resistant strains circulating in the community such as the Extended-spectrum β -lactamase (ESBL) *Escherichia coli*. In response to concerns about such organisms in the community, the International Scientific Forum on Home Hygiene has produced a report evaluating MRSA, *C. difficile*, and ESBL-producing *E. coli* from a community viewpoint. The report summarizes what is known about their prevalence in the community, their mode of transmission in the home, and the extent to which they represent a risk. It also includes "advice sheets" giving practical guidance on what to do when there is a risk of infection transmission in the home. (Am J Infect Control 2007;35:86-8.)

For bacterial strains, such as methicillin-resistant *Staphylococcus aureus* (MRSA), *Clostridium difficile*, and extended-spectrum β -lactamase (ESBL)-producing *Escherichia coli*, the use of antibiotics is a common factor that is related to their emergence and spread. Although health care-associated MRSA (HCA-MRSA) and *C difficile* strains are primarily a risk to vulnerable

patients in hospitals, people are increasingly aware and concerned about the potential for these organisms to circulate between the hospital and other settings, including the home. Thus, they are looking for support to understand the extent of the risk to themselves and their family, and guidance on how to deal with situations where preventing infection from these species may become their responsibility (eg, caring for someone at home who is infected or has increased vulnerability to infection, or visiting someone in the hospital who may be at risk from visitors who are colonized or infected).

A further, and possibly greater, concern are the "newer" community-acquired MRSA (CA-MRSA) and *C difficile* strains that are now known to have emerged *de novo* in the community from community-based strains. In contrast with HCA-MRSA, CA-MRSA strains are more virulent, and cause infections of cuts, wounds, and abrasions, which are more prevalent among children and young adults. One of the main reasons for concern is that these strains have acquired the ability to produce Panton-Valentine leukocidin (PVL) toxin, which can lead to serious and potentially

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fatal skin and soft tissue (sometimes necrotizing) infections. Although the data are difficult to interpret, because they are mostly generated by Reference Laboratories, it is thought that a significant portion of PVL-producing strains circulating in the general community are also methicillin resistant.^{1,2} Indications are that these PVL-producing CA-MRSA strains are easily transmissible not only within families, but also on a larger scale in community settings (eg, prisons, schools, sport teams) and among intravenous drug addicts; skin-to-skin contact (including unabraded skin) and indirect contact with contaminated shared objects (e.g., towels, sheets, sports equipment) seem to represent the main mode of transmission. This is particularly likely where there are shared contaminated items, poor hygiene, and crowded living conditions. A further concern is that these strains are now showing the propensity to not only spread rapidly in the community, but also into hospitals, thereby compromising efforts to control MRSA in these settings.^{2,3}

For *C difficile*, concerns in the community relate to the emergence of a more virulent type (type NAP1/027) that seems to have the ability to produce greater quantities of toxins, and, unlike many previous *C difficile* strains, is resistant to fluoroquinolone antibiotics. In the United States in 2005, several cases of *C difficile*-associated disease were reported in patients in whom there was minimal or no exposure to health care settings and no recent antibiotic use (ie, they were community acquired).⁴

In response to concerns about such organisms in the community, the International Scientific Forum on Home Hygiene (IFH) produced a report that evaluated MRSA, *C difficile*, and ESBL-producing *E coli* from a community viewpoint.⁵ The report summarizes what is known about these organisms, their prevalence in the community, their likely mode of transmission in the home, and the extent to which they represent a risk. Its purpose is to provide a source of information for health professionals, scientific writers, and others who communicate directly with the public on infectious disease and home hygiene. The appendices include "advice sheets" that give practical guidance on what to do when there is a risk for infection transmission in the home. In accordance with IFH policy, the evidence base for the practical information is reviewed.

The report suggests that, for all 3 species, although home-dwellers who are infected or colonized with these organisms are reported frequently in the literature, the overall prevalence of infected individuals or colonized carriers in the community, at least in the UK, is still low. It is recognized, however, that geographical variations occur; this prevalence may be increasing in parts of the United States.⁶ The evidence suggests that when these strains are introduced into the home

by an infected individual or a carrier or via domestic animals, there is significant potential for spread by direct or indirect contact (eg, via the hands; hand, body, or food contact surfaces; cleaning cloths), such that other family members are exposed and may become colonized or infected. The prevalence and potential for spread of MRSA in the home environment is shown by a recent study at the Center for Hygiene and Health at Simmons College in Boston, MA (Elizabeth Scott, BSc, PhD, personal communication, 2006). The CA-MRSA was isolated from 7 of 35 homes (20%) that were sampled in the Boston area; it was found on a variety of household surfaces, including hand contact surfaces and cleaning utensils.

The major concern in public health terms is that, as the proportion of people in the general population who carry these strains as part of their normal flora increases, there is an increasing probability that clinical infections, either in the community or in the hospital, may be attributable to one of these strains. Although the IFH report highlights significant differences between these 3 strains, it also suggests common patterns. From this it is possible to formulate a strategy that could reduce the impact of these and other emergent strains. The key components of such a strategy include better monitoring of antibiotic utilization together with promotion of appropriate hygiene to prevent spread from infected or colonized family members, protect vulnerable groups from exposure, and reduce transmission among healthy family members.

In situations where someone is known to be infected with or carrying a specific pathogen, or where family members need to be protected against a specific pathogen (eg, CA-MRSA), hygiene advice to the family can be based on assessment of the critical control points for preventing spread of the particular organism. In contrast, reducing the circulation of these organisms in the healthy community by reducing opportunities for spread of colonization among family members and domestic animals depends on persuading people to practice good hygiene on a routine basis. Good day-to-day hygiene means adopting the IFH risk assessment or "targeted" approach to home hygiene as outlined in the IFH Guidelines and Recommendations on home hygiene, or in the IFH home hygiene training resource.⁷⁻⁹ In situations where someone is more vulnerable to infection, for the most part this still means targeted hygiene. The major difference is that, if hygiene practices are not applied consistently and rigorously, the risk for infection is much greater.

In reality, the problems that are posed by "emergent pathogens" are only one of the reasons why we need to persuade the public to share the responsibility for infection control and adopt better standards of

day-to-day hygiene. Other factors include the continuing high levels of infectious intestinal disease; the increasing elderly population and shorter hospital stays, which mean greater numbers of vulnerable people in the community; and the emergence of diseases, such as severe acute respiratory syndrome (SARS) and avian flu. To achieve this, however, we need to abandon our fragmented approach to hygiene promotion—whereby food hygiene advice is given separately from advice on hand hygiene, care of the sick, or preventing the spread of flu or MRSA—and look at hygiene holistically from the point of view of the family and the range of problems that they face in protecting themselves from infection. The fact that advice on these aspects of hygiene is given separately means that the community does not have a comprehensive understanding about how infectious diseases are spread in the home; thus, hygiene practice largely is rule based. This makes it difficult for hygiene knowledge to be adapted to different risks (eg, those posed by pathogens with dissimilar properties and routes of transmission), or to the varying needs of different family members with various levels of vulnerability to infection. The threat that is posed by diseases such as avian influenza and SARS demands an immediate response, which requires adequate and advance preparation. To achieve all this, greater emphasis on appropriate hygiene education in schools is needed. Additionally, the public must be given clear, unambiguous information on the nature of the threat posed by infectious disease agents

together with advice on how to target hygiene measures to minimize the risks of exposure to potentially harmful microbes.

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