

why tracking and control of CRE has been particularly problematic in *Enterobacteriaceae* (Belluco et al. 2016).

The main goal of this review is to approach AMR in bacteria as a worldwide health problem, namely, in two main medically important Gram-negative bacteria, *E. coli* and *K. pneumoniae*. We also focus on the causes of AMR, widespread dissemination of AMR genes that can affect animals and humans, main causes of that resistances, and consequences and future strategies to alleviate the threat.

11.3 Causes of Antimicrobial Resistance

As we mentioned before, the main factors for the development of AMR are use, overuse, and misuse of antimicrobials (Bengtsson-Palme and Larsson 2015; Höjgård 2012). However, lengthy hospitalization, invasive procedures, and admission to the intensive care unit (ICU) are other important factors of colonization and infection with MDR organisms (Cristina et al. 2016). Centers for Disease control and Prevention (2013) highlighted the antibiotic use in a population as a primary driver of the AMR, associated with the development of resistant bacteria.

The abuse and misuse of drug compounds (such as antibiotics, antifungals, and antivirals) can also lead to this global health concern and compromised prevention and treatment of an ever-increasing range of infections caused by bacteria, fungi, and viruses (WHO 2016). According to Sosa et al. (2010), the antibacterial drug rate is higher when compared with antifungal or antiviral agents. However, it is also important to consider other factors like human migration (He et al. 2016), the failure to complete antibiotic treatment (Brauner et al. 2016), incorrect dose treatment (Cornejo-Juárez et al. 2015), or wrong selection of the antimicrobial (Lynch et al. 2013).

It is also important to consider the production and distribution of counterfeit medication, including fake antibiotics, in general presenting low and variable concentration of the active compounds that can contribute to the development of AMR (Khuluza et al. 2016; Venhuis et al. 2016). In the case of developing countries, antimicrobials can often be purchased without prescription. According to WHO (2016), “poverty and inadequate access to drugs continue to be a major force in the development of resistance.” In the same way, particular MDR bacteria are common because of poor sanitary conditions, in contrast with the developed world (Okeke et al. 2005; Sosa et al. 2010). The inadequate access to effective drugs, medication sharing, self-prescription, and manufacture of antimicrobials of questionable quality represent some factors that contribute to the growth of MDR organisms (Planta 2007).

Another situation is the frequent and widespread use of antimicrobials in agricultural procedures. Animals and humans are compromised because resistant bacteria can transfer potentially resistant genes to humans by