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Antibiotic Resistance in Environment and its Public Health Risks in Iran

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The World Health Organization (WHO), in its June 2014 report announced antibiotic resistance as one of the major challenges of the current century [1]. Antibiotic resistance is responsible for the death of millions of people worldwide [2]. These factors impose a heavy financial pressure on governments and individuals. Numerous reports by researchers around the world indicate that antibiotic resistance is expanding rapidly [3]. While expressing a serious concern, WHO has warned the risk of returning to the era before the discovery of antibiotics [1]. Antibiotic resistance is a multi-aspect issue; in other words, it has engaged not only the medical treatment sectors, but also all parts of the environment (water, wastewater, air, and soil), agriculture, and animal husbandry. Many researchers believe that antibiotic resistance, especially the one produced in medical environments, would find a way to enter other parts of the society and cause an antibiotic resistance cycle within the society [4]. For example, studies have proved that antibiotic-resistant bacteria and genes enter the environment through the produced wastewater, consequently wastewater treatment plants are the only controlling barriers within the environment. Wastewater treatment facilities not only are unable to remove these factors (agents), but also have a synergistic effect on them [5]. Furthermore, removal of these factors requires advanced treatment processes and necessitates spending long periods of time, especially in developing countries.

Although all countries in the world are dealing with this challenge, its risk is highly serious in developing countries [6]. In these countries, the technological weakness, poor management of control systems, low per capita income, lack or weakness of antibiotic resistance-relevant laws, as well as lack of a specific program for dealing with this issue have led to the significant growth of antibiotic resistance [7].

Iran, as one of the developing countries, is faced with this problem. Almost all studies conducted in this realm, reported antibiotic resistance and bacterial-resistant genes in medical environments [8, 9]. The important and worrying point is that antibiotic resistance in medical environments is an epidemic. Antibiotic resistance is closely associated with generation and increase of hospital

infections, increased mortality rate, as well as increased health and medical costs.

Results of studies demonstrated that the resistant bacteria and genes enter the environment through municipal and hospital wastewaters. Surprisingly, the entrance pattern of resistant bacteria and genes to the environment is consistent with entrance pattern of these factors to the medical environment. The worrying point is that a major part of the medical effluents enters the environment without being treated and the municipal and hospital wastewater treatment plants are unable to remove these factors [10, 11]. The environmental studies in Iran have shown that the prevalence of antibiotic resistance is very high in water resources, wastewater, soil, and even hospital air [12-14]. Such prevalence includes almost all of the antibiotic and bacterial groups. Most of the environmental studies in Iran have reported multiple resistance [4, 15]. Accordingly, a large part of these factors is discharged to the environment [16]. Researchers have shown that the resistant bacteria and genes can enter the water resources from wastewaters and then enter the water distribution network through the treated water and jeopardize the consumers' health [17-19]. Moreover, these factors were identified in farming fields, air, and other environmental areas [20]. Therefore, it seems that antibiotic resistance within the environment, as a serious problem, has exposed the public health to serious threats. In this regard, to control the antibiotic resistance within the environment and reduce the health risks, the following solutions can be useful:

- Adopting macro-policies on antibiotic resistance control in the environment;
- Conducting comprehensive nation-wide studies on antibiotic resistance in the environment;
- Equipping water and wastewater treatment systems with advanced (modern) processes;
- Evaluating actual health-related risks resulted from resistant bacteria and genes in the environment; and
- Using successful global experiences in the field of antibiotic resistance management.

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