Environmental Health Engineering and Management Journal 2018, 5(2), 77–78
http://ehemj.com
doi 10.15171/EHEM.2018.11

Environmental Health Engineering and Management Journal

Letter to Editor

Environmental Health Engineering and Management

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Antibiotic resistance: A link from local bio-pollution cycle to global dissemination

Reza Ghanbari[1], Saeed Aali[2], Seyed Hamed Mirhoseini[3], Reza Abbaszadeh Dizaji[4], Rahim Aali[5,6*]

[1]Department of Environmental Health Engineering, School of Public Health, Qazvin University of Medical Sciences, Qazvin, Iran
[2]Department of Urology, Kashani Public Hospital, Shahrekord University of Medical Sciences, Shahrekord, Iran
[3]Department of Environmental Health Engineering, School of Health, Arak University of Medical Sciences, Arak, Iran
[4]Department of Disater & Emergency Health, School of Public Health, Tehran University of Medical Sciences, Tehran, Iran
[5]Cellular and Molecular Research Center, Urmia University of Medical Sciences, Urmia, Iran
[6]Department of Environmental Health Engineering, Khoy University of Medical Sciences, Khoy, Iran

***Correspondence to:** Rahim Aali, Email: aali1400@gmail.com
Citation: Ghanbari R, Aali S, Mirhoseini SH, Abbaszadeh Dizaji R, Aali R. Antibiotic resistance: A link from local bio-pollution cycle to global dissemination. Environmental Health Engineering and Management Journal 2018; 5(2): 77–78. doi: 10.15171/EHEM.2018.11.
Received: 29 December 2017; Accepted: 16 February 2018; ePublished: 28 February 2018

Dear Editor,

Antibiotics passed their "golden age" too early by the emergence of antibiotic resistance as a global challenge (1-3). Today, antibiotic resistance is known as a progressive and chronic disease in the conventional and modern healthcare systems worldwide (2) and is directly related to antibiotic consumption in the societies. The World Health Organization (WHO) has identified antibiotic resistance as one of the three critical challenges of the current century (4). The developed antibiotic resistance can easily affect patients, those accompanying them and other people associated with patients and hospitals. It also increases mortality as well as costs and reduces life quality in therapeutic environments. The cycling of antibiotic resistance in hospitals challenges its management and control and annually leads to hundreds of deaths. Antibiotic resistance is not merely limited to the healthcare environments and hospitals, but also it could enter to the environmental resources. It has also been identified as one of the environmental contaminants (5,6).

These factors could re-enter drinking water and water sources via environmental resources or be transferred through particles and affect the public. The transfer of resistance genes between water and soil resources and clinical environments has been confirmed (7-9) and the cycle of these factors has been investigated at national and local levels (10). Moreover, it has been reported that mortality rate caused by these factors is higher than death rate by AIDS in the United States. In order to control the problem, different countries have applied many programs at local and national levels. WHO's recommendations have also been at both local and national levels. The results of studies have demonstrated that antibiotic resistant bacteria (ARB) and antibiotic resistance genes (ARGs) have not been decreased over the past years, but followed an incremental trend and experienced expanded dimensions. Furthermore, in some reports, they have been mentioned as non-controllable factors (2).

Investigations have demonstrated that the influence of these factors goes beyond the local, national, and even regional levels. These factors have been reported even in impassable and unusual places in different regions of the world, from those places reachable for humans to polar areas and the mountains, where there is no human access, as well as in marine bacteria at the distance of 522 km from the coastline and at 820 m depth (3,7,11). Some studies have also reported that these factors can transfer airborne agents. In addition, the hydrological cycle provides a very suitable ground for the maintenance and transfer of these factors.

Kaushik et al confirmed the growing use of rainwater and the falling of ARB from the atmosphere to domestic systems (12). Rainfall itself is caused by the hydrological cycle and annually moves about 40×10^{12} tons of water around the world (13,14). Nevertheless, changes in the hydrological cycle cause variations in global temperature, and climate patterns influence the intensity, time and location of the prevalence of antibiotic resistance and infectious diseases. Therefore, as ARB and ARGs are the international issues, trans-regional planning and policymaking should be arranged for them, and global responsibilities should be defined in this regard. The point that highlights the need for considering this issue

is that, first, resistant bacteria have high durability in bioaerosols and could easily transfer antibiotic resistance. Second, studies have shown that the acquired resistance is usually irreversible. Nevertheless, these factors can transfer from an area with high frequency to another with low frequency and, practically, increase the burden of diseases and healthcare costs. Another important point is that transferring these factors to developing countries, where there are fewer facilities and less management, is a challenge (15).

Antibiotic resistance as one of the biological contaminants has a global dimension, therefore, for the solution of this problem, global accountability is required. Moreover, consistent and committed measures are needed in planning and policy making by all countries.

Ethical issues

Not applicable.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

All authors contributed equally to the study and critically reviewed, refined, and approved the manuscript.

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