

Chapter 18

Pharmaco–EcoMicrobiology and Its Potential Role in Medical and Environmental Sciences

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ABSTRACT

Despite the call of the World Health Organization (WHO) for “Pharmacovigilance,” i.e. the monitoring, detection, assessment, and prevention of any adverse reactions, poor attention has been given to identify the long term and short term Adverse Effects (ADEs) of antimicrobial agents on the environment. It is obvious that most of the health sectors across the globe are occupied by infectious diseases (e.g. tuberculosis, HIV, and hepatitis), and to combat such threats, the pharmaceutical industries are pouring tons of drugs and reagents into a market worth billions of dollars. The discharge of these products into the ecosystem is potentially a threat to the environment and human health. In this chapter, the authors depicted a recently described terminology, “Pharmaco-EcoMicrobiology” (PEcM), that could cover these problems and their possible solutions on medical and environmental aspects. In this regard, the role of pharmacoinformatics could also be crucial, since it can provide swift information for implementation and use of information technologies for the discovery and development of drugs as well as in pharmacy education and also the detection and combat of adverse drug effects.

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INTRODUCTION

The World Health Organization (WHO) defined “Pharmacovigilance” activities as the monitoring, detection, assessment, understanding and prevention of any adverse reactions to drugs at therapeutic concentration on animals and humans (Mann & Andrew, 2002). Inadequate attention has been given to identifying the long term and short term Adverse Effects (ADEs) of antimicrobial agents on the environment (given at therapeutic doses). Furthermore, the continuous spread of various infectious diseases such as MDR, XDR, sputum positive pulmonary tuberculosis, avian influenza, H1N1, NDM-1, hepatitis, and also bird flu, along with other veterinary microbial/viral diseases (or drug based animal pandemics), could be attributed to the interactions called Pharmaco-EcoMicrobiology (i.e. the interaction between therapeutic wastes with environment). The severity of these interactions could have various grades of consequences, which varies from milder form to irreversible environmental damage disturbing the homeostasis of the ecosystem. These changes could result into the evolution of new drugs and antibiotic resistant species of various flora and fauna, which have the potential to alter the disposition of pre-existing interactions called *k* and *r*-selections.

In this chapter, we tried to depict a more elaborate terminology that can cover the entire problem and its possible solutions in medical aspects. In this regard, the role of pharmacoinformatics is crucial, since it can provide swift information for implementation and use of information technologies for the discovery and development of drugs as well as in pharmacy education. A great effort has been made by Rahman et al. (2007) to enunciate the new term “Pharmacoenvironmentology,” which covers the environmental impact of drugs given to humans and animals at therapeutic doses (Rahman, Khan, Gupta, & Uddin, 2007). However, we found at the same time that this is partial towards environmental damage, not

describing in detail the more important aspect of infectious- and resistant- diseases. Hence, there is an urgent need to elaborate the relation of Pharmacology and Medical Microbiology keeping in view the importance of Ecological balance, since the outbreak of recent epidemics and their association with contamination of environment by pharmaceutical metabolite (discharge) have come to light. In the existing literature, the terminology “Pharmaco-EcoMicrobiology” has been given as a broad spectrum platform that defines the interplay between antimicrobial pharmacological agents and animate microbial ecology (Mann & Andrew, 2002; Shahid, Khardori, Tripathi, & Bergman, 2010). This new domain, “Pharmaco-EcoMicrobiology,” has been derived by the aggregation of three important branches of life science, i.e. pharmacology, ecology, and microbiology, which would be responsible for studying the Adverse Drug Effects (ADEs) due to antimicrobial drugs disposed in the environment due to human negligence (Mann & Andrew, 2002). The role of PEcM is important in dealing with the issues of harm associated with the use of given medications and assists in avoiding the hazards of adverse drug reactions. The lack of information and infrastructure for educating pharmacists and medical practitioners about the potential risk of dosage of drugs, which invariably affects the health of the patient, is of major concern in medical community. Pharmaco-EcoMicrobiology (PEcM) can provide an indispensable support for carefully monitoring adverse drug events and their potential danger in damaging the environment.

Keeping in view of the already available literature focusing on the association of pharmaceutical discharges to the environmental damage, the present hypothesis elaborates the association of these discharges on the spread of infectious diseases, drug resistant microbes/virus, and their effect on human health and environment. There is an urgent need to elaborate the more important relationship of infectious microbes and their resistant strains with pharmaceutical waste

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