Chapter 9
The Evolving Role of Pharmacoinformatics in Targeting Drug-Related Problems in Clinical Oncology Practice

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ABSTRACT

The rapid growth of the internet and the World Wide Web has led to the development of pharmacoinformatics technologies to assist oncology healthcare professionals in delivering optimum pharmaceutical care and health-related outcomes. The proliferation of online health information has also empowered patients with cancer with the knowledge to better participate in the management of their own condition. This chapter introduces the evolving roles of pharmacoinformatics in oncology and discusses some problems that have arisen due to these technologies. Various pharmacoinformatics channels for practitioners and patients are described together with drug interaction parameters that are clinically relevant to oncology clinicians. Additionally, this chapter addresses certain quality issues associated with online anticancer drug interactions and proposes several design principles for developers of pharmacoinformatics tools. Finally, readers will be given an insight as to how pharmacoinformatics can be harnessed for the future improvement of pharmaceutical care in patients with chronic diseases such as cancer.

INTRODUCTION

The practice of pharmaceutical care forms the cornerstone of any health science discipline which concerns itself with the rational use of drugs. Its concept combines a careful blend of caring orientation with specialized therapeutic knowledge, experiences, and judgments, so as to ensure optimal medication-related outcomes (American College of Clinical Pharmacy, 2005; American Society of Hospital Pharmacists, 1993). These outcomes include the prevention or cure of diseases, elimination or reduction of symptoms, and slowing or arresting of disease processes

DOI: 10.4018/978-1-4666-0309-7.ch009

(American Society of Hospital Pharmacists, 1993). Healthcare professionals, particularly clinical pharmacists, apply their knowledge and understanding of evidence-based therapeutic guidelines, evolving sciences and relevant ethical, social and economic principles so as to provide optimal medication therapy management in direct patient care settings. Clinical researchers, on the other hand, aim to contribute to new knowledge which improves the patients' health and quality of life (American College of Clinical Pharmacy, 2005).

Pharmaceutical care is essential in helping patients make the best use of their medications, and is applicable and achievable in any practice setting. It involves identifying, solving and preventing potential or actual drug-related problems with regards to a patient's drug therapy (American Society of Hospital Pharmacists, 1993; Westerlund, Almarsdóttir, & Melander, 1999). There are a number of definitions to drug-related problems, but in essence, they can be easily understood as events or circumstances involving drug therapies that can actually or potentially interfere with the desired health outcomes for patients (American Society of Hospital Pharmacists, 1993; van Mil, Westerlund, Hersberger, & Schaefer, 2004). The Pharmaceutical Care Network Europe Foundation classifies drug-related problems in terms of problems and causes (Table 1) (Pharmaceutical Care Network Europe, 2006). The former classification identifies the drug-related problems in terms of dosing, drug use and drug choice problems, as well as potential drug-drug, drug-food or drug-herb interactions, and adverse drug reactions. On the other hand, drug-related problems can also be due to the drug/dose selection and process, or patient-related and pharmacy logistics issues. A lack of knowledge or misinterpretation of information about the drug and its use can contribute to such drug-related problems, leading to patient non-compliance, and the patients' safety and quality of life can be significantly compromised if they are not treated effectively and appropriately.

Drug interactions are commonly encountered in daily clinical practice. This is due to an increasing use of combination therapies for patients, and the presence of polypharmacy in the geriatric population. A drug interaction is defined as a change in the way a drug acts in the body when taken with certain other drugs, herbs, foods, or when taken with certain medical conditions (US National Institutes of Health, 2011). They may cause the drug to be more or less effective, or cause a unique response that does not occur when either agent is given alone. The term 'drug interaction' is often used to refer to drug-drug interactions (Council on Family Health, National Consumers League, & US Food and Drug Administration, 2004), and this chapter follows this convention as well. However, it is important to note that other drug-food and drug-herb interactions can also occur. Approximately 20-30% of all adverse drug reactions are due to drug interactions (Beijnen & Schellens, 2004; Kuhlmann & Mück, 2001). The potential for an interaction is about 6% when two drugs are prescribed together for a patient, and the risk of such interactions increases with the number of drugs in the prescription (Kuhlmann & Mück, 2001). These reactions are relevant clinically in up to 80% of the elderly (Beijnen & Schellens, 2004), and can be a problem with the growing aging population. In general, drug interactions can be a result of pharmacokinetic, pharmacodynamic, or pharmaceutic mechanisms. Pharmacokinetic interactions involve alterations in the absorption, distribution, metabolism, or elimination properties of a drug, which can be due to enzyme induction or inhibition, or protein displacement; while pharmacodynamic interactions can be due to antagonistic, additive, or synergistic effects of the individual drugs. On the other hand, pharmaceutical interactions occur when chemically incompatible drugs are co-administered, which lead to precipitation and inactivation of the therapeutic effects of the drugs (Chan & Yap, 2010; Yap, Chui, & Chan, 2008). Risk factors for drug interactions include