

Budget impact model for oncoparmacogenetics from the perspective of mandatory basic health insurance in Switzerland using the example of breast cancer

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Abstract: Single-nucleotide polymorphisms (SNPs) can severely impact individual drug response and health outcomes in cancer patients. Genetic tests to screen for marker SNPs are available to adjust the drug dose of oncologicals to the patient's needs. However, it is unclear whether the positive effects outbalance the increased costs or even lead to an overall cost reduction. This very pragmatic analysis used three frequently used oncologicals for the treatment of breast cancer to evaluate whether preemptive pharmacogenetic testing may have a cost-reducing impact on health care spending in the Swiss health care system. Our results indicate that oncoparmacogenetics might help to reduce health care costs (ie, by avoiding adverse drug effects) and to increase efficiency of drugs in oncologic patients.

Keywords: pharmacogenetics, oncology, budget impact model, Switzerland, health insurance

Introduction

Single-nucleotide polymorphisms (SNPs) can severely impact individual drug response and health outcomes in oncologic patients. Genetic tests to screen for marker SNPs are available to adjust the drug dose of oncologicals to the patient's needs, and this information – as opposed to dynamic plasma measurements – does not change over time.^{1,2} However, it is unclear whether the positive effects outbalance the increased costs or even lead to an overall cost reduction.³

The aim of this very pragmatic analysis is to give a crude but illustrative first idea of whether preemptive pharmacogenetics testing may have a cost-reducing impact on health care spending related to cancer drugs in the Swiss health care system. We therefore used the example of three frequently used oncologicals for the treatment of breast cancer (tamoxifen, capecitabine, and lapatinib). The Swiss National Institute for Cancer Epidemiology reported 76,489 prevalent and 4,733 incident cases of female breast cancer in Switzerland in 2015.⁴

Methods

To estimate drug costs and use of these drugs, we analyzed real-life drug reimbursement data of one of the largest Swiss basic mandatory health insurances, including persons from all parts of the country (10,794 persons with tamoxifen, 3,022 persons with capecitabine, and 10 persons with lapatinib). For each of these cancer drugs, the share of breast cancer patients treated with these drugs was calculated by dividing

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Table 1 Active components and share of patients treated

Active component	Share of patients treated (%)
Tamoxifen	14.11
Capecitabin	3.95
Lapatinib	0.01

Table 2 Results of the budget impact of model by active components with the corresponding genes

Oncological Gene	Prevalence of gene	Sales volume of drug (CHF)	Patient population treated with drug and presenting with corresponding gene (population at risk) (N)	Costs of test (CHF)	Number of new cases who get treated with the drug and therefore need to get tested per year (N) ^a	Costs for patient population at risk (CHF) ^a	Difference between annual drug costs in population at potential risk and expected annual costs for genotyping (CHF)
Tamoxifen <i>CY2D6</i>	0.47	2,051,099	5,074	333	668	964,016	741,583
Capecitabin <i>DPYD</i>	0.04	4,427,049	121	198	187	177,082	140,074
Lapatinib <i>HLA</i>	0.25	102,274	3	238	0,62	25,569	25,422

Note: ^aThis was calculated by multiplying the drug sales volume with the prevalence of the correlating gene.

the prevalence of breast cancer by the number of persons receiving the corresponding drug in health insurance claims, projected to the total population of Switzerland (Table 1).

For each drug, the sales volume for the patient population presenting with the correlating gene was calculated, based on the prevalence of genes taken from the literature.⁵ Genotyping costs were requested from Swiss or international companies. Currency exchanges were made based on the current currency exchange rate, which was 1 USD = 0.9895 CHF.

Results

Table 2 shows a broad variability of the difference between annual test costs for genotyping in all incident cases and the costs for treatment in patients with the corresponding gene. The more positive the difference, the higher the likelihood of oncoparmacogenetic testing to be cost effective. If drug treatment costs for patients do not exceed that difference, oncoparmacogenetic testing will be cost saving. However, it is very likely that dose modifications based on oncoparmacogenetic test results avoid adverse events, which leads to additional significant savings. The more adverse events can be avoided, the higher the likelihood for cost effectiveness of oncoparmacogenetic testing.

Discussion

The present pragmatic analysis indicates that oncoparmacogenetic testing might help to reduce health care costs and

to increase efficiency of drugs in oncologic patients. More specifically, the present study supports the demand for more detailed studies using properly defined populations, and based on a rigorous scientific protocol, to evaluate potential positive effects on patient-relevant outcomes, potential risks, and costs in a highly dynamic system. However, in addition to developing new active components, it might be just as important to use already existing drugs in a more efficient manner.

Disclosure

The authors report no conflicts of interest in this work.

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