



An Overview of Drug Repurposing: Review Article

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Abstract

Drug Repurposing is finding new use of an already existing drug. It offers affordable, cheap and faster treatment. Strategies such as in-silico models, data mining, artificial intelligence etc. help accelerate it. However there are few barriers which need to overcome like legal and economic barriers. Collaboration between various sectors, awareness and encouragement can promote in flourishing of drug repurposing which holds a great future in the modern medicine sector.

Keywords: *Drug Repurposing, Artificial Intelligence, Rare Diseases, Orphan drugs, Corporate Social Responsibility.*

Introduction

Drug Repurposing can be compared to recycling. It is the application of known drugs for treating conditions other than their original use.¹

Drug repurposing offers drugs at a much cheaper, faster and accessible way to the patient population.²

The drug studied for repurposing are the shelved drugs which either could not made to the late phases of clinical trials or have failed in the market. Since the efficacy, safety and toxicity of the drug is already known, the initial phases of the clinical trials can be skipped which brings down the cost and duration of the clinical trials. It takes about 15 years to bring a new drug to the market whereas repurposed drug is cuts down both the duration (3 to 12 years) and costs.³

The challenges are to identify the right compound for the new purpose, to use the resources judiciously and to not fail again after bringing the failed drugs back into clinical trials.⁴

Strategies for accelerating drug repurposing

1. In-silico models- In-silico models or bioinformatics help in identifying the complex relationships among drugs, targets and diseases required for repurposing.⁵
2. Target docking – Using high-throughput screening technologies to find out polypharmacological compounds acting on multiple targets can cure multifactorial diseases like cancer, neurodegenerative diseases.⁶
3. Artificial intelligence (AI)- AI improves access to data. Extensive data mining in literature to find out drug interactions, adverse effects, mechanism of actions, gene regulations can help accelerating drug development.⁴ The side effect of one drug can be used as a treatment for another condition. If drugs have same adverse effects then they may work on same disease.²

Pathway mining which involves identifying a specific pathway which is linked to different diseases and hence finding out drugs to hit that particular pathway for curing of diseases.⁴

Barriers

1. Regulatory

If a shelved compound is brought back to the clinical trial it has to pass through all the regulatory requirements like filling NDA, issue of secondary patents, updated pharmacokinetic profile which is a time consuming, costly and complicated process.⁷

2. Low economic returns

For the company which acquires the secondary patent by going through all regulatory norms, it can't be assured that it will recover its Research and Development (R&D) costs by marketing of the drug because for the drug which is already available in the market, the company can't set a new price for the drug. It still will be continued to be used for new purpose at the same old price.⁷

If a new use for an already generic drug has been discovered, it is difficult to ascertain that the clinicians will prescribe or the pharmacists will sell the drug of a particular manufacturer. Hence, the company which invested for the Drug Repurposing R&D will have low profit or worse will be at loss.⁷

3. Financial risk

For drugs mean to treat rare disease or orphan drugs the population in use is small and hence the economic return. The company has to put a huge risk in the investment for those kinds of drugs.⁷

Steps to promote Drug Repurposing

1. Collaboration is the key to success. Collaboration between industries, academias, government, non-government organisations, and philanthropists brings different ideas and approaches.²
2. Corporate Social Responsibility (CSR) to reach out to the population suffering from rare, acute and malignant diseases and helping them by providing treatment/drugs in an accessible way.
3. Social media to create awareness about Drug Repurposing, sharing of experiences about the

off labelled used drug like side effects, curable rates etc.

Financial incentives by government and philanthropists can reduce the burden on companies which suffer from dilemmas to invest in R&D of drugs whose success is unsure.

Conclusion

Drug Repurposing is the future of modern medicine. Proper strategies and techniques can help revolutionise DR to meet the unmet need of the population especially in the field of orphan drugs.

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