Diving into registry data

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Introduction

With hundreds of drugs currently approved for use on the Norwegian market, **drug repurposing** is an efficient alternative way to finding new treatments for known diseases.

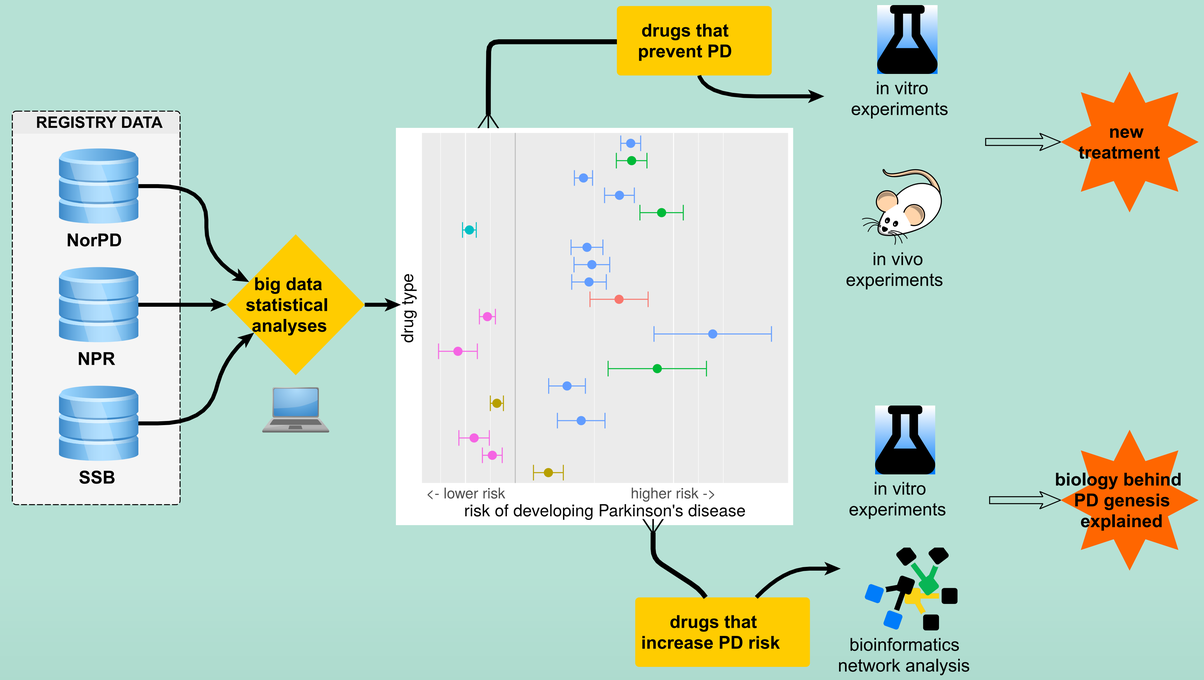
Norwegian national registries collect vast amount of information per each Norwegian citizen. These data can be used in advanced analyses to check for patterns of drug usage and illnesses and to **find drugs associated with risk changes of a given disease.**

Our project, **DRONE** (https://link.uib.no/drone), focuses on neurological diseases, specifically:

- *Parkinson's disease (PD)*,
- *multiple sclerosis (MS)*,
- *amyotrophic lateral sclerosis (ALS)*,
- and *Alzheimer's disease (AD)*.

Data

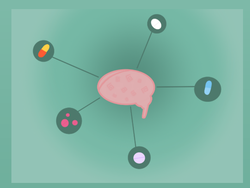
1. entire *Norwegian Prescription Registry (NorPD)*:
   - ca.680 mln prescriptions
   - timeline: 2004–2019
   - ca.1800 various drugs
2. selected diagnose codes from *Norwegian Patient Registry (NPR)*:
   - timeline: 2008–2019
3. demographic information from *Statistics Norway (SSB)*:
   - study population: ca.4.5 mln individuals



Virtual clinical trials based on entire Prescription Registry

epidemiology + bioinformatics + machine learning + experiments

-> Drug Repurposing for NEurological diseases = **DRONE**



Methods

1. *Epidemiology:*
   - Cox regression
   - time-lag analyses
   - dose-response analyses
2. *Bioinformatics:*
   - molecular structure similarities
   - target and side-target similarities (*ChEMBL*) **(Gaulton et al. 2017)**
   - exploring various relationships between the drugs and disease (*Hetionet*) **(Himmelstein et al. 2017)**
3. *Machine learning* (TODO)
   - searching for patterns in drug usage
   - predicting disease onset
4. *Experiments*
   - collaboration with Dr. Clemens Scherzer

Results

Pilot of this study has been published **(Mittal et al. 2017)** where epidemiological analyses showed that usage of β-adrenoreceptor *antagonists* increased the risk of developing PD, while usage of β-adrenoreceptor *agonists* decreased that risk. This was confirmed by experiments *in vitro* and *in vivo*.

Discussion

- how to define the **patients** based solely on the prescriptions?
- how to define **exposure** to a drug?
- neurological diseases may have a long prodromal phase – how to define **onset date** of a disease?
- how to take into account **combinations of drugs**?

References

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