

# Introduction to precision medicine with focus on novelties and pain management

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# Hot topics terminology

- ◉ Evolutional biology
- ◉ Genetics
- ◉ Epigenetics
- ◉ Longevity
- ◉ Tunnel vision
- ◉ Heterogeneity...population based data...philosophy
- ◉ Mathematical models
- ◉ Optimization/multi criteria decision making(MCDM)

- ◎ **Precision medicine/precision HEALTH**
- ◎ Precision Public Health | Data-driven decision support for families, communities, clinics, social networks, and other entities . Potential treatments can also be policies. Precision Health Union of precision medicine and precision public health. We always consider the consequences of our actions on the populations involved not just narrow subgroups or individuals

S_wakeup	-0.18	0.09	-0.09	0.04	-0.22	0.11	-0.01	-0.02	-0.08	-0.31	-0.12	0.06	0.11	-0.35	1
S_Nblocks_spt_wake_LIG	0.01	0.17	0.85	-0.02	-0.1	-0.06	-0.16	0.26	0.24	0.97	-0.07	0.21	0.18	1	-0.35
S_Nblocks_spt_sleep	-0.17	-0.02	0.09	0.03	-0.12	-0.05	0.14	-0.08	-0.03	0.11	-0.45	-0.26	1	0.18	0.11
S_Nblocks_day_LIG_bts_10	-0.03	-0.11	0.16	0.12	0.01	0	-0.17	0.41	0.42	0.32	0.47	1	-0.26	0.21	0.06
S_Nblocks_day_IN_unbt	0.07	-0.28	-0.18	0.07	0.19	0.13	-0.22	0.13	0.12	-0.01	1	0.47	-0.45	-0.07	-0.12
S_dur_spt_wake_LIG_min	-0.08	0.2	0.83	0.05	-0.18	-0.14	-0.11	0.39	0.36	1	-0.01	0.32	0.11	0.97	-0.31
S_dur_day_VIG_unbt_min	-0.26	0.2	0.14	0.32	-0.18	-0.21	0.43	0.9	1	0.36	0.12	0.42	-0.03	0.24	-0.08
S_dur_day_total_VIG_min	-0.33	0.2	0.17	0.35	-0.28	-0.33	0.46	1	0.9	0.39	0.13	0.41	-0.08	0.26	-0.02
S_ACC_day_total_MOD_mg	-0.25	0.02	-0.21	0.35	-0.19	-0.42	1	0.46	0.43	-0.11	-0.22	-0.17	0.14	-0.16	-0.01
S_ACC_day_LIG_bts_10_mg	0.3	-0.13	-0.07	-0.3	0.39	1	-0.42	-0.33	-0.21	-0.14	0.13	0	-0.05	-0.06	0.11
D_wakeup_time	0.83	-0.14	-0.17	-0.05	1	0.39	-0.19	-0.28	-0.18	-0.18	0.19	0.01	-0.12	-0.1	-0.22
D_sleep_time	-0.43	0.06	-0.06	1	-0.05	-0.3	0.35	0.35	0.32	0.05	0.07	0.12	0.03	-0.02	0.04
S_Nblocks_spt_wake_MOD	0.01	0.33	1	-0.06	-0.17	-0.07	-0.21	0.17	0.14	0.83	-0.18	0.16	0.09	0.85	-0.09
S_ACC_day_LIG_unbt_mg	-0.01	1	0.33	0.06	-0.14	-0.13	0.02	0.2	0.2	0.2	-0.28	-0.11	-0.02	0.17	0.09
D_sleep_zenith	1	-0.01	0.01	-0.43	0.83	0.3	-0.25	-0.33	-0.26	-0.08	0.07	-0.03	-0.17	0.01	-0.18
	D_sleep_zenith	S_ACC_day_LIG_unbt_mg	S_Nblocks_spt_wake_MOD	D_sleep_time	D_wakeup_time	S_ACC_day_LIG_bts_10_mg	S_ACC_day_total_MOD_mg	S_dur_day_total_VIG_min	S_dur_day_VIG_unbt_min	S_dur_spt_wake_LIG_min	S_Nblocks_day_IN_unbt	S_Nblocks_day_LIG_bts_10	S_Nblocks_spt_sleep	S_Nblocks_spt_wake_LIG	S_wakeup

$$\begin{aligned}
 \frac{dS}{dt} &= -\beta SI \\
 \frac{dE}{dt} &= \beta SI - \sigma E \\
 \frac{dI}{dt} &= \sigma E - \gamma I \\
 \frac{dR}{dt} &= \gamma I
 \end{aligned}$$

Where:

SS is the number of healthy cells.

EE is the number of pre-cancerous cells.

II is the number of cancerous cells.

RR is the number of treated cells.

$\beta$  is the rate at which healthy cells become pre-cancerous.

$\sigma$  is the rate at which pre-cancerous cells become cancerous.

$\gamma$  is the rate at which cancerous cells are treated.

This model can help researchers understand the progression of cancer and evaluate the effectiveness of different treatment strategies. For example, by adjusting the parameters  $\beta$ ,  $\sigma$ , and  $\gamma$ , researchers can simulate the impact of various interventions, such as chemotherapy or radiation therapy, on the dynamics of cancer cell populations.

# Important notes:

- PK data usually obtained from standard healthy population.
- Patients condition affect PK.
- Alteration in PK parameters may influence directly on pain management.
- The behavior of agonist/antagonist related to a complicated algorithm of concentration in front of receptors.

- Bioavailability
- C max { which compartment}
- Absorbtion
- Distribution & Vd
- Metabolism
- excretion

- TDM?
- Biomarkers?
- Pharmacogenomics?
- Microbiota?
- Inducer/inhibitors(smoking)
- Injectable ER formulations



# Gadgets: eg: like for diabetes:

Prediction  
Diagnosis  
Monitoring



# Great concept:

- Sometimes we need a non-linear method for thinking:
- eg: linear.....biomarker.....if....then.
- non linear: change of twitching threshold



Warning: We`re gonna lose  
the future if

