Recommendations to mitigate input of pharmaceuticals – CWPharma project results

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BSR Water final conference

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CWPharma project

- CWPharma
  - 10/2017 – 12/2020
  - EU Interreg BSR (2,9 M€)
  - 15 project partners, 7 countries
- Data
  - Case studies
  - Consumption statistics
  - Advanced WWT, waste and industry
  - Modelling

www.cwpharma.fi/en-US

Why reduce emissions?

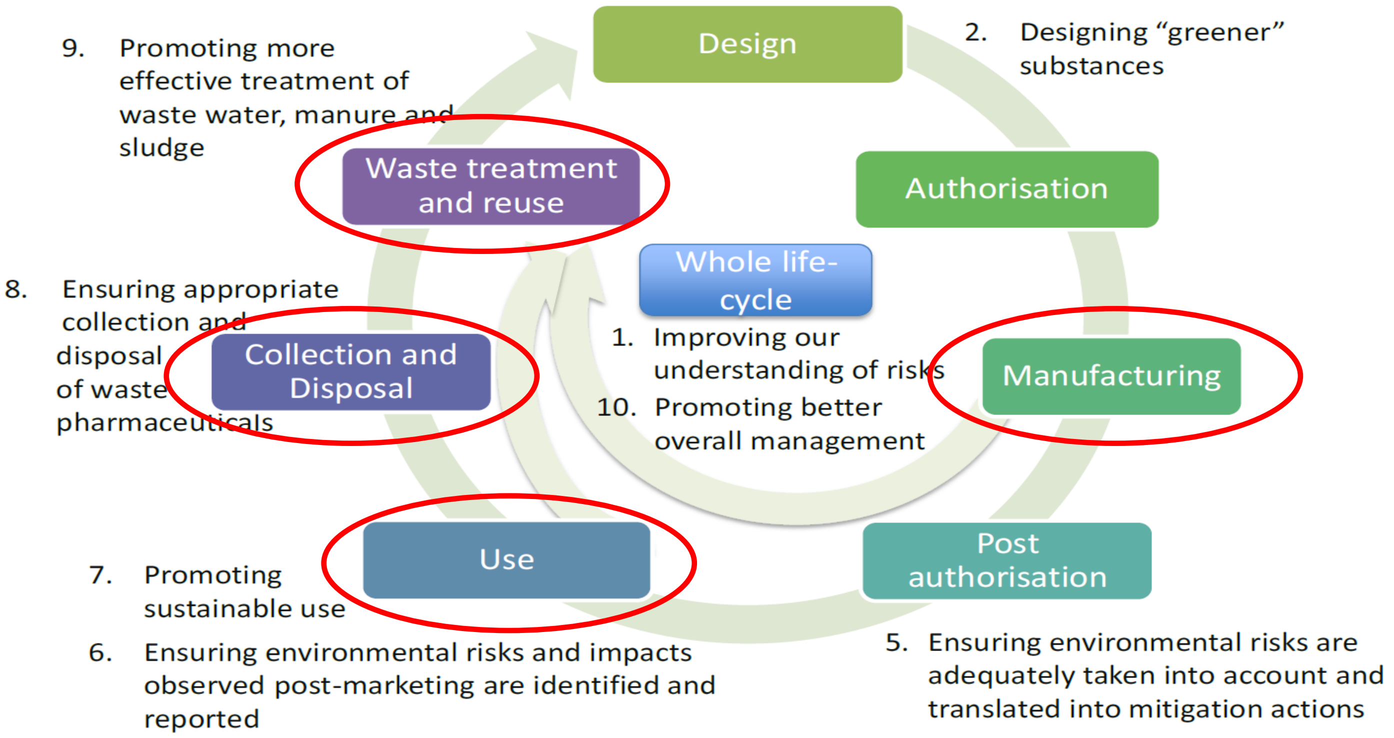
- Many active pharmaceutical ingredients (APIs) exceed the predicted no-effect concentrations (PNECs) in surface waters

API	DE	EE	FI	LV	PL	SE
Norethisterone	X	X	X	X	X	X
Clarithromycin	X	X	X	X	X	
Mometasone furoate		X				
Emamectin benzoate	X	X		X	X	X
Estrone	X	X	X	X	X	
Diclofenac	X		X	X	X	X
Ofloxacin					X	X
Doxycycline						X
Metformin				X		

X = PNEC exceeded in at least one surface water sample

Ek Henning et al. 2020

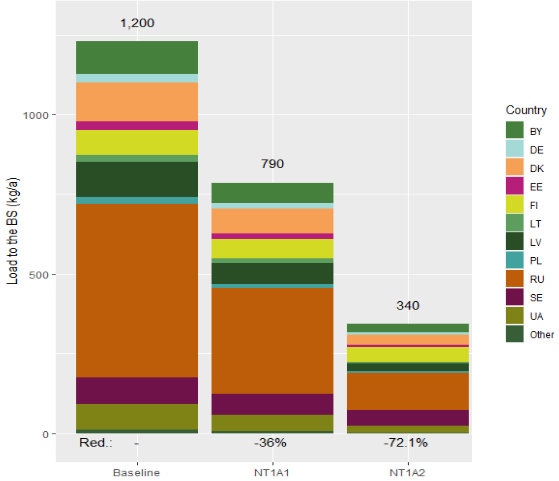
Pharmaceutical lifecycle



Waste management

- Improving the collection and permanent destruction of unused pharmaceuticals would reduce emissions from improper waste management
  - Room for improvement in the BSR

Ibuprofen



Äystö & Stapf 2020

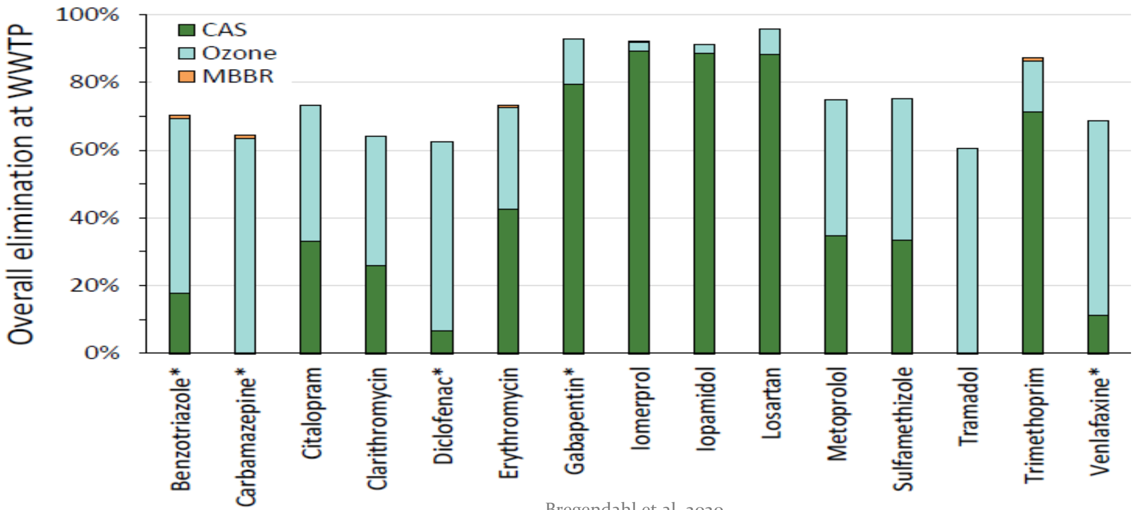
- Relatively effective for extensively metabolized APIs
  - E.g. ibuprofen and carbamazepine

Country / year of interviews or year when study was published	Share of the surveyed people that returned unused pharmaceuticals to pharmacies and hazardous waste collection points	Share of the surveyed people that flushed unused pharmaceuticals to sewer	Share of the surveyed people that disposed unused pharmaceuticals to mixed household waste
Finland / studies made 2009–2010	65% (60–80%)	3%	16%
Latvia / studies made in 2012 & 2014	6–10%	5–12%	41–62%
Lithuania / study made in 2013	10–13%	no info	50–64%
Poland / 2015 (study published)	5-8%	24–33%	57–60%
Sweden / studies made in 2011 & 2012	69–75%	≈ 17%	
Russia / 2013 (study published)	no info	15%	80%

Mehtonen et al. 2020

WWTP technologies

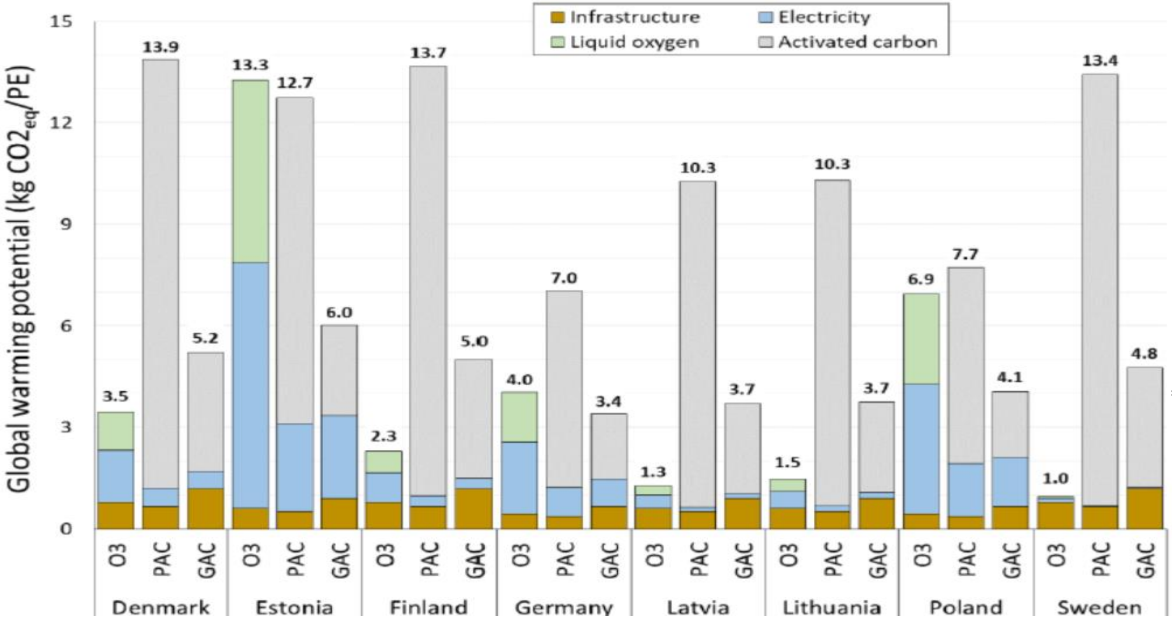
- Effective in eliminating APIs that are removed poorly in conventional treatment processes
  - E.g. diclofenac, carbamazepine and tramadol



Bregendahl et al. 2020

WWTP technologies

- Trade-off between reduced pharmaceutical load and increased GHG emissions



Äystö & Stapf 2020

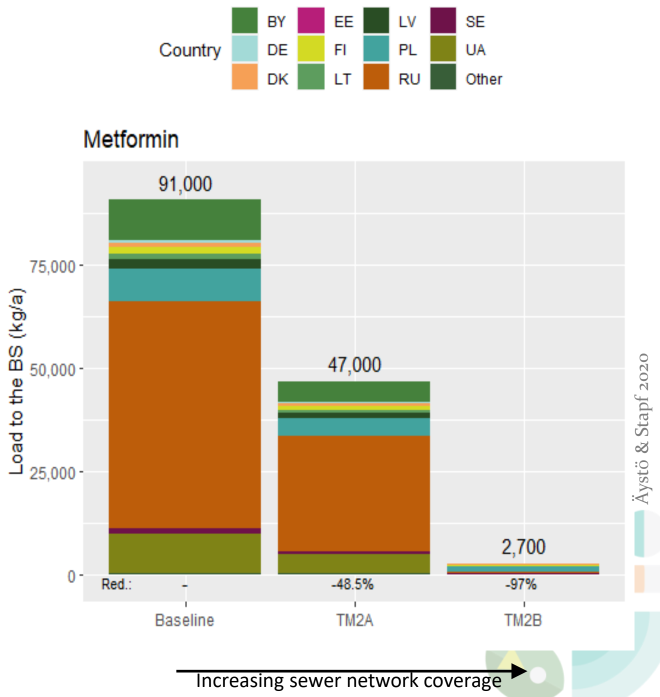
Sewer networks

- Higher sewer network coverage

⇒ More pharmaceuticals removed at centralized WWTPs

- Effective for APIs that are removed using conventional processes
  - E.g. ibuprofen and metformin

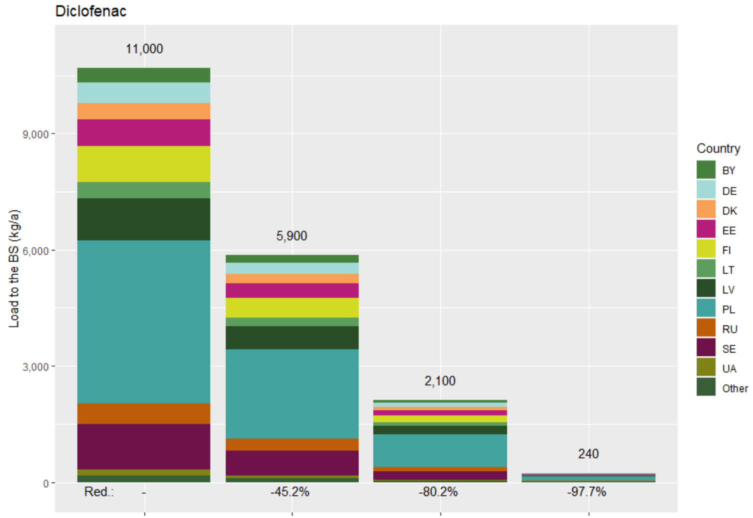
- High potential in areas where sewer network coverage is currently low



Prescription & usage practices

- Reducing the use of environmentally harmful APIs estimated to result in similar decrease in environmental load
  - However, is it feasible..?

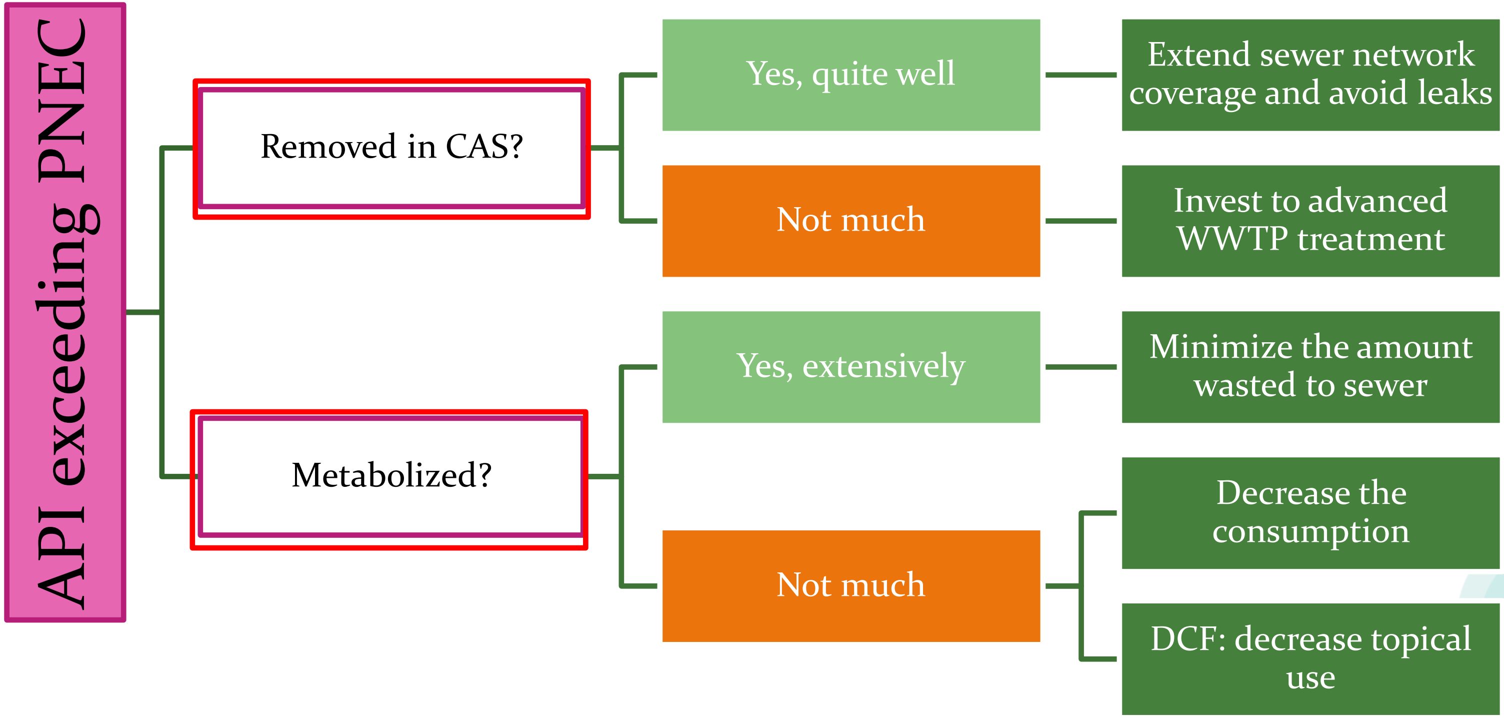
- Reducing/eliminating topical use of diclofenac would be an effective way to reduce DCF load to the BS



Topical use
% of total use:
65 %
50 %
25 %
0 %

Äystö & Stapf 2020

How to decrease API emissions?

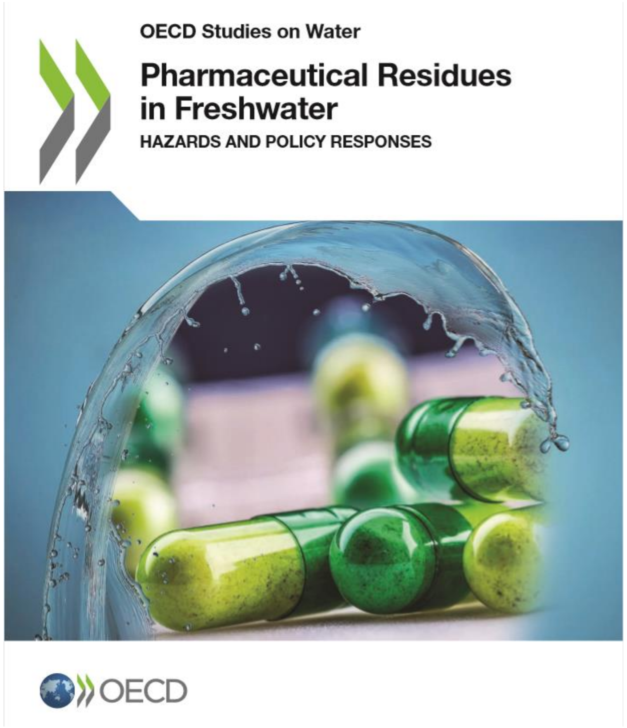


Recommendations

- Actions for avoiding API discharges
  - Proper collection and disposal of pharmaceutical waste
  - Awareness raising
  - Consumption, replacement
- Actions for reducing API discharges from WWTPs
  - Properly working WWTPs, network coverage
  - Advanced treatment, 1st to largest WWTPs
- Actions for supporting future regulations
  - Environmental permits of pharma industry
  - Monitoring of APIs
  - Research – occurrence and effects

OECD: Pharmaceutical Residues in Freshwater

- *“End of pipe measures should **only** be used **in complementary to source-directed and use-orientated measures**. An over-emphasis on upgrading of wastewater treatment plant (WWTP) infrastructure is not a sustainable, optimal use of limited resources.”*



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Tekniska verken

LÄNSSTYRELSEN ÖSTERGÖTLAND

fimea
Finnish Medicines Agency

DWA
Clear Concepts. Clean Environment.

LATVIJAS VIDES, ĢEOLOĢIJAS UN METEOROLOĢIJAS CENTRS

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KOMPETENZZENTRUM WasserBerlin

Interreg
Baltic Sea Region

EUROPEAN UNION

EUROPEAN REGIONAL DEVELOPMENT FUND

EU STRATEGY FOR THE BALTIC SEA REGION
FLAGSHIP

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