

Sex/Gender Differences in Clinical Pharmacology

How Sex-Based Pharmacology Leads to Safer, Smarter Treatment

Why Gender Matters in Pharmacology

Men and women are not just different in size — they process drugs differently.



Pharmacokinetic & Pharmacodynamics Differences

Women

- ↑ Fat & ↓ plasma → ↑ Vd
- ↑ CYP3A4/2B6
- ↓ GFR

Men

- ↑ CYP2D6
→ beta-blocker metabolism

Children

- Immature liver/kidneys
- ↑ water
- ↓ fat

Elderly

- ↓ liver & kidney function
- ↑ fat
- ↓ muscle



Women

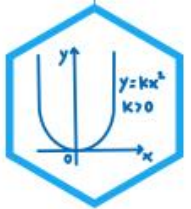
receptor sensitivity effect & ADRs

Estrogen

Modulates opioid and antidepressant response

Children/Elderly

More sensitive to CNS effects



Drug Safety & Gender Representation

ADR Risk



50~75%



Women are 50–75% more likely to experience adverse drug reactions

Trial Gap

Women underrepresented in trials safety data incomplete

To make medicine truly precise,
sex and gender must be part of the equation

Clinical Examples



Zolpidem

Women have ~45% higher AUC compared to men.
FDA lowered the recommended dose for women by 50%.

Tamoxifen

Women show higher C_{max} than men,
indicating sex-based metabolic variation.

Side effects

Women experience more adverse effects like constipation,
dizziness, and headaches from opioids and SSRIs.

***Precision Medicine Isn't Precise
Without Sex and Gender.***

To ensure safe and effective treatments,
drug development must reflect the realities of
sex, gender, and age.

This is not personalization — this is precision.