Preamble

- Should not be in same chapter with confounding...

- a very different topic !! (can have both, but ... see diagram)

Definitions ...

Interaction (statistical)

- "Non-additivity" of "effects" in regression

- need for product term in regression analysis (osm)

  - scale dependent

(Effect) Modification (epidemiological)

- Inconstancy of a parameter of a relation over other subject characteristic (osm)

- Different slopes for different folks (jh)

"Modifier (of a relation)

- A characteristic (of individuals) on which a parameter of a relation depends (osm)

Examples...

• Equation for Ideal Weight as function of Height

- modification by Gender

• Average Earnings as function of Education / Age

- modification by Gender

• Decline in Bone Density with Age

- Different in 19th and 20th Centuries

• ?Can hit further with aluminum than wood baseball bat?

- Difference depends on where on bat one hits ball

• Changes over time in injury rates

- Different in intervention and reference areas?

Translating these into regression equations ...

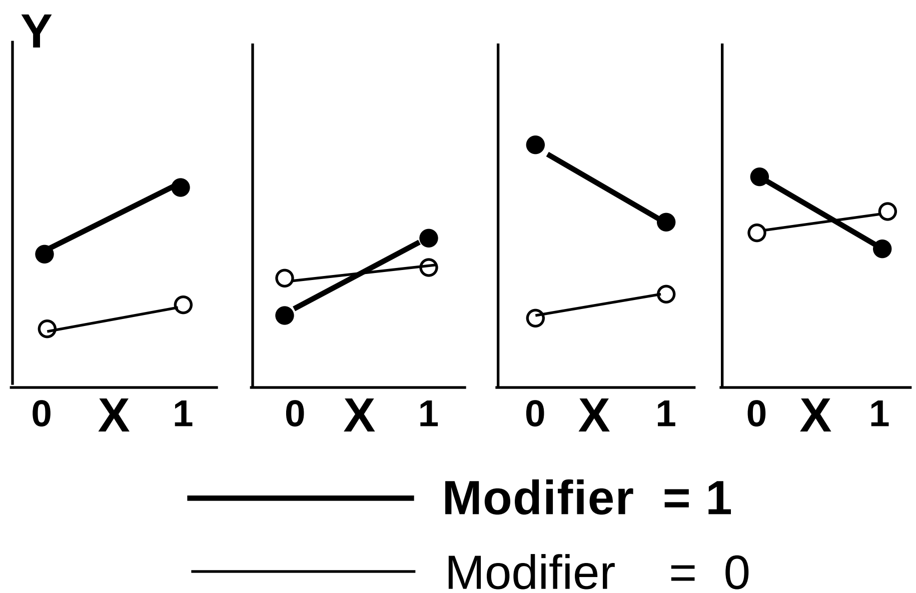
- relation between Y and X

- "modifier" variable M

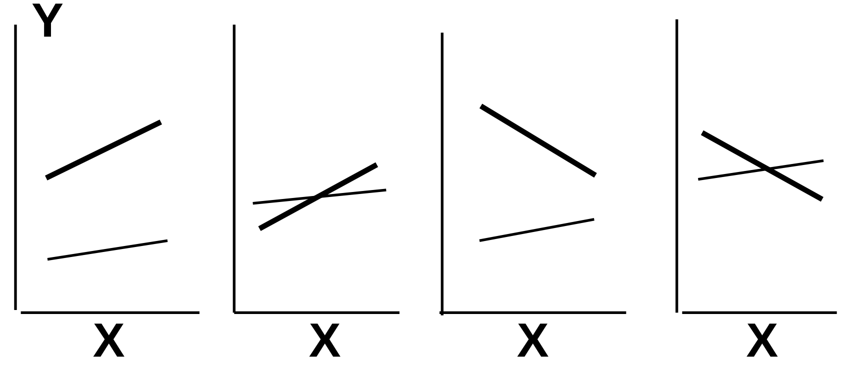
E[Y | X, M] = B0 + B1.X + B2.M + B3.(M.X)

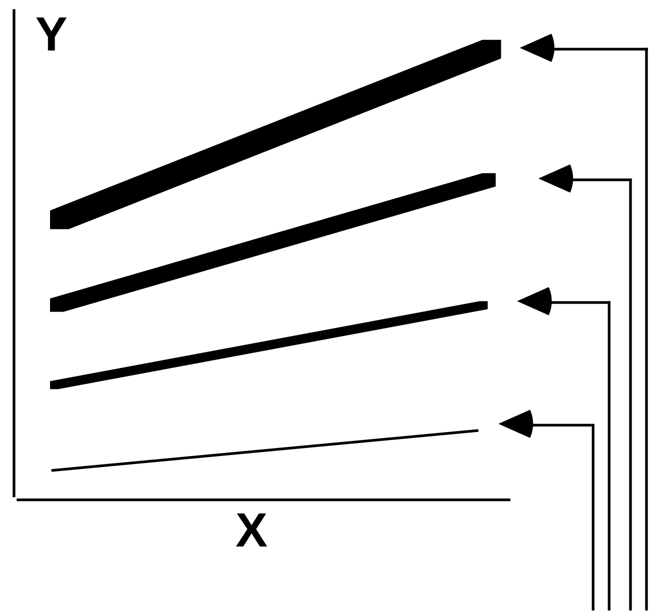
- <u>Special cases..</u>

X binary, M Binary



X continuous, M binary

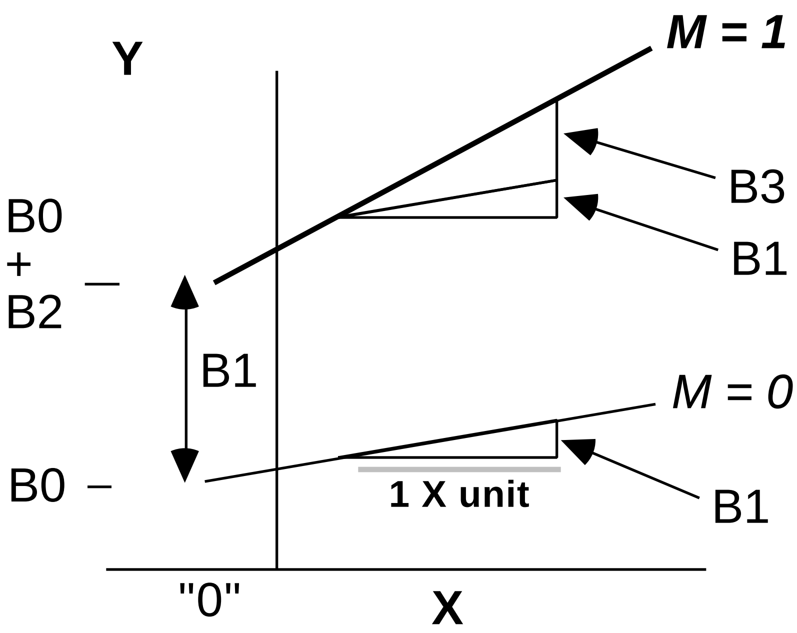




Quantitative levels of Modifier M

Meaning of the coefficients

X continuous, M Binary



- helpful ways of rewriting the equation

E[Y | X, M] = B0 + B2.M + (B1 + B3.M).X

Special issues

• mathematical symmetry of equation

E[Y | X1, X2] = B0 + B1.X1 + B2.X2 + B3.(X1.X2)

= B0 + B2.X2 + (B1 + B3.X2).X1

X2 modifies the Y<->X1 relation

= B0 + B1.X1 + (B2 + B3.X1).X2

X1 modifies the Y<->X2 relation

• to a regression program, X1.X2 product terms are just like any other terms.. but

they tend to be correlated (collinear) with the components from which they are made, so...

*** user should "center" the components before ***

*** making (or having computer make) products ***

(will see example in injury prevention study)

Translating equations back into lines ...

- **If M is binary...**

start with the M=0 case

B0 + B1.X + B2.M + B3.(M.X)

= B0 + B1.X + B2.0 + B3.(0.X)

= B0 + B1.X

===> straight line in X with intercept B0 and slope B1

"turn on" the M=1 toggle...

B0 + B1.X + B2.M + B3.(M.X)

= B0 + B1.X + B2.1 + B3.(1.X)

= B0 + B1.X + B2 + B3.X

collect terms that do not involve X & those that do..

(B0 + B2) + (B1 + B3).X

===> straight line in X with intercept (B0 + B2) and slope (B1 + B3)

- **If M is continuous...** as above with several M values