# Encouragement Designs

Holland (1988)    Powers & Swinton (1984)

Intervention: Encouragement to study
(for a test)
random assignment to treatment-control
$G=1$        $G=0$

Student studies amount R

Student outcome, achievement test
score, Y

For each unit observe:

$$Y, \quad R, \quad G$$

## • Questions

1. What's the increase in study time from Encouragement?

2. What's the increase in achievement from studying an hour longer?

3. What's the increase in achievement if no increase in study? (placebo effect: concentration, motivation, etc.)

4. What's the total impact on achievement?

# Counterfactual Data For Individual u

### with parameterization

1. Difference in amount of study time for u when in treatment vs when in control:

$$R_t(u) - R_c(u) = \rho(u)$$

2. Difference in outcome score for studying amount r vs studying amount r':

$$Y_{Gr}(u) - Y_{Gr'}(u) = (r - r')\beta(u)$$

3. Difference in outcome score when in treatment vs when in control with same amount of study $r$ :

$$Y_{tr}(u) - Y_{cr}(u) = \gamma(u)$$

4. Overall difference in outcome score when in treatment vs when in control :

$$Y_{tR_t}(u) - Y_{cR_c}(u)$$
$$= \gamma(u) + \rho(u)\beta(u) \quad (Direct + indirect)$$

# Formulation For Encouragement Designs
## "Counterfactual Data"

1. $R_t(u) - R_c(u) \quad = \quad \rho(u)$

2. $Y_{Gr}(u) - Y_{Gr'}(u) \quad = \quad (r - r')\beta(u)$

3. $Y_{tr}(u) - Y_{cr}(u) \quad = \quad \mathcal{T}(u)$

4. $Y_{tR_t}(u) - Y_{cR_c}(u) \quad = \quad \mathcal{T}(u) + \rho(u)\beta(u)$

DIRECT + INDIRECT

4 ACE's: Expectation over units

# Formulati[...] Encouragemen[t]
## Designs
### "Counterfactual Data"

1. $R_t(u) - R_c(u)$

$\rho$

2. $Y_{Gr}(u) - Y_{Gr'}(u)$

$\beta(r - r')$

3. $Y_{tr}(u) - Y_{cr}(u)$

$\tau$

4. $Y_{tR_t}(u) - Y_{cR_c}(u)$

$\tau + \rho\beta$

4 ACE's

over

# Unit (Individual) Level Model

Amount of study:

$$R_G(u) = R_c(u) + \rho(u)G$$

Outcome score:

$$Y_{Gr}(u) = Y_{co}(u) + \gamma(u)G + \beta(u)r$$

↑

Outcome score of $u$ if not encouraged and studies 0 time.

Simplest model (Holland, 1988)

No individual differences

$$\rho(u) = \rho \;;\; \beta(u) = \beta \;;\; \gamma(u) = \gamma$$

What does path analysis do?

Topic for next week